



Environmental Social Impact Assessment (ESIA) for Rehabilitation and Closure of Municipal Solid Waste Disposal Sites in Philipsburg, Sint Maarten

National Recovery Program Bureau

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Responsibility

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List of abbreviations and acronyms

Abbreviation	Meaning
ARAP	Abbreviated Resettlement Action Plan
COC	Contaminants of Concern
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
DTM	Digital Terrain Model
EDMP	Emergency Debris Management Project
EHS	Environmental, Health, and Safety
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
C-ESMP	Contractor Environmental and Social Management Plan
EU	European Union
GRM	Grievance Redress Mechanism
GSP	Great Salt Pond
HDPE	High-Density Polyethylene
IDS	Irma Disposal Site
ISDS	Integrated Safeguards Data Sheet
ISWMF	Integrated Solid Waste Management Facility
LEL	Lower Explosion Limit
LFG	Landfill Gas
LLDPE	Linear Low-Density Polyethylene
LRP	Livelihood Restoration Plan
MAC	Maximum Allowable Concentrations
MSWDS	Municipal Solid Waste Disposal Sites (SWDS and IDS together)
NRPB	National Recovery Program Bureau
OEL	Occupational Exposure Level
OHS	Occupational Health and Safety
PAHs	Polycyclic Aromatic Hydrocarbons
PAP	Project Affected Persons
PCB	Polychlorinated Biphenyls
PIU	Project Implementation Unit
PM	Particulate Matter
RAP	Resettlement Action Plan
SWDS	Solid Waste Disposal Site
TSS	Total Suspended Solids
VOC	Volatile Organic Components
VROMI	Ministry of Public Housing, Spatial Planning, Environment and Infrastructure
WWR	Windward Roads

0 Executive Summary

0.1 Introduction

Sint Maarten struggles with a weak municipal solid waste management system. Despite recent improvements in operational management, the Municipal Solid Waste Disposal Sites (MSWDS) on Sint Maarten side of the island do not operate in line with International Best Practise. Since the start of its operation in the seventies, the Solid Waste Disposal Site (SWDS), and later the Irma Disposal Site (IDS), both situated at Pond Island in Philipsburg and collectively referred as the Municipal Solid Waste Disposal Sites (MSWDS), operate without a legal and regulatory framework and serve as open dumpsites for the whole country with limited supervision, operational workflows, waste measures and controls.

After Hurricane Irma (2017), the government, backed by a Dutch-financed and World Bank administered Trust Fund under the “Building Back Better” programme, launched the Emergency Debris Management Project (EDMP) to clear debris and rehabilitate waste facilities. The National Recovery Program Bureau (NRPB) has tasked the Witteveen+Bos–TAUW consortium with preparing a feasibility study, concept design and procurement documents to upgrade, enlarge and eventually close the dumps, while providing interim capacity and paving the way for an integrated, non-disposal waste system.

This Environmental and Social Impact Assessment (ESIA) evaluates the social and environmental impacts of upgrading and closing the MSWDS by 2032.

A Design and Build (D&B) contractor will be procured. The D&B will be required to prepare a design for the closure of the MSWDS in combination with the building works for the closure of the IDS and ensuring geotechnical stability at the SWDS as preparation for its closure after termination of the landfill operations. Contractor shall ensure that its design shall not result in any new significant impacts or any worsening of the impacts described in the ESIA.

0.2 Baseline conditions

Sint Maarten’s SWDS and the adjacent IDS serve as the country’s only disposal sites yet operate as non-engineered open dumps. Roughly 43,000 residents and 2.4 million tourists generate 9.7 kg day⁻¹ of waste per-capita. Municipal trash and other waste, including tires were accepted at the SWDS side and bulky debris, including vegetative debris, pallets, construction debris, white goods and other miscellaneous large items are accepted at the IDS. VROMI supervises both sites via private contractors but levies no residential fee, uses no weighbridge and enforces minimal waste screening; a disposal fee is planned for 2025.

Neither landfill has a liner, leachate control, gas system or formal management plan. Daily cover is erratic—imported dredged clay or on-site sand and construction and demolition fines are used when available. Continuous placement has expanded SWDS to ~162,000 m² (maximum height 42 m, ~2.8 Mm³) and IDS to ~57,000 m² (20 m, ~0.49 Mm³). Many of the steep slopes are geotechnically unstable, with main macro-instability risks along the SWDS north face and IDS south-east. Although largely controlled, subsurface smouldering and intermittent surface fires

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continue to be present, generating local air-quality concerns for the homes and businesses in the proximity.

A 2018 fire-and-stability study set two buffer zones around the SWDS/IDS: a primary zone requiring community relocation and a wider notification zone.

National Recovery Program Bureau's (NRPB) 2022 Resettlement Action Plan (RAP) subsequently compensated 143 Project Affected Persons (PAPs), including 104 individuals, 32 businesses, 5 employees and two waste pickers from an area indicated as the resettlement area of impact (RAI). Most PAPs opted for cash compensation, with only six families choosing replacement housing. The RAI demolition was completed in June 2025, and the site was handed over to VROMI.

Legal, Regulatory and Policy Framework

Sint Maarten, an autonomous country within the Kingdom of the Netherlands, is not considered an independent State under international law, however, Sint Maarten enjoys an associated status to the European Union (EU) as an Overseas Country and Territory (OCT) under the Lisbon Treaty. Part of the Great Salt Pond (GSP) is a protected national monument and also an Important Bird Area. Environmental and social regulation derives largely from former Netherlands Antilles ordinances, supplemented by Sint Maarten's Constitution, national ordinances and international treaties, yet enforcement is limited. Waste-related works at the SWDS/IDS require hindrance, infrastructure/civil-works and building permits. Air-quality, wastewater, leachate and noise limits follow the 2007 Netherlands Antilles Environmental Norms (WMNA). The World Bank classifies this project as Category A, and Operational Policies 4.01, 4.04, 4.09, 4.11 and 4.12 apply. The World Bank Group Environmental, Health, and Safety Guidelines (EHSG) for Waste Management Facilities apply.

Environmental and Social Baseline Information

Sint Maarten has a tourism-driven economy (per capita ~US\$25,400.00). The climate is tropical marine: easterly trade winds, with a 27 °C mean temperature and a June–November hurricane season.

Baseline studies around the SWDS/IDS on Pond Island show a densely populated area, with mixed commercial/residential activities immediately south of the landfill. All former residents inside the resettlement area of impact were relocated in 2024, but three entities, i.e., Steel Crusher (a metal-scrap yard), Windward Roads (construction debris processing facility) and the Soccer Association, still require relocation for the proposed work for the landfill.

The GSP was historically used for salt production. Pond Island is reclaimed fill over permeable beach sand atop clay. Leachate migrates freely between the landfill body and the brackish GSP, contaminating groundwater with elevated EC, BOD, COD, nutrients, metals and bacteria; estimated leachate production is 91–133,000 m³ yr⁻¹. Surface-water sampling (2019) found low dissolved oxygen, high coliforms and PAH exceedances, the impacts are only partially to be attributed to the landfill as several pollution sources contribute to the deterioration of the water quality in the GSP. Dust and occasional landfill-fire smoke are the main air-quality issues; monitoring in 2019 showed sporadic PM10 exceedances and traces of metals and PAHs, but no

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off-site health risks under non-fire conditions. Methane generation at the MSWDS is modelled at 1,450 t CH₄ yr⁻¹ (peak 2027), but no spreading of landfill gasses has been detected in off-site monitoring programs.

The GSP remains ecologically important for its mangroves, saline vegetation and habitat for numerous bird species, crabs and other wetland wildlife, although biodiversity around the landfill itself is limited and impacted by invasive species. The following vulnerable migratory birds that attend the area have been registered; Black-bellied Plover (*Pluvialis squatarola*), White-rumped Sandpiper (*Calidris fuscicollis*), Lesser Yellowlegs (*Tringa flavipes*). The following near threatened species have been recorded in the area; Stilt Sandpiper (*Calidris himantopus*), Greater Yellowlegs (*Tringa melanoleuca*), Ruddy Turnstone (*Arenaria interpres*). No near threatened or vulnerable birds are known to nest within the project area.

Soualiga Road is the sole access route to the SWDS/IDS; 5,000 vehicles were counted over two observation days, and truck-hour bans are not enforced.

0.3 Project Description

This ESIA identifies the significant impacts of implementing a concept design, and identifies the measures needed to protect people and the environment, comply with all applicable policy, regulation and standards, and deliver a safe, sustainable closure of the landfill sites. The content and extent of the environmental and social impacts presented in this ESIA have been identified through field testing, research and scoping, meetings and consultations. The project includes the following actions:

- Reprofile the waste bodies to plateaued 1: 3 slopes, reaching 36 m (SWDS) and 24 m (IDS), then cease filling; IDS will be finished in about 60 weeks, SWDS 52 weeks after dumping stops
- Construct a 4–5 m-wide ring dike around the perimeter for access, erosion control and added stability; reinforce landfill slopes with HDPE geocells and reuse existing rock armour plus recycled C&D aggregate
- Install a 1.8 m security fence and a storm-water system: 5 % surface fall to GSP and precast-gutter drainage on the landward side
- Place an engineered final cover comprising of support sand, 2 mm Linear Low-Density Polyethylene (LLDPE) liner, drainage mat, geocell layer, and 0.5 m vegetated top-soil; the cap both cuts infiltration (there is no leachate collection)
- Collect landfill gas through a network of horizontal gas drains linked to compost biofilters
- Procure mobile shredding and crushing equipment so VROMI can process incoming waste and produce recycled aggregate for ring-dike and road works
- Landscape the dike with juvenile (red-)mangrove plantings (1 per 0.8 m²) to offset habitat loss. These measures eliminate normal-condition slope-failure risks, reduce leachate and methane emissions, control access and runoff, and prepare the sites for permanent closure and ecological rehabilitation
- Establishing auxiliary facilities in the RAI (contractor compound, recycled-aggregate stockpiles) and relocating two onsite active businesses prior to works to the VROMI yard or other area of preference

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0.4 Environmental and Social Impacts

Assessment of Environmental and Social Impacts and Risks

The key impacts predicted during the construction phase are:

- **Social Impacts:** two commercial entities need to be relocated, and one association needs to be compensated for their plot for the reconstruction of the IDS and SWDS. One entity manages construction and demolition (C&D) wastes, including crushing rocks and other materials and sifting/storing crushed materials (materials used locally by the entity), while another entity crushes car wrecks and metals for export. The two entities will be resettled in VROMI yard. For the Association, the Government will provide replacement land. Abbreviated Resettlement Action Plan (ARAP), including a Livelihood Restoration Plan (LRP) will be prepared and implemented to describe how this will be undertaken in compliance with World Bank operational policy requirements
- Residents, businesses and educational centres, leisure facilities and government activities on Pond Island and the area between Pond Island and the port facilities will be impacted during construction phase by increased traffic, dust and noise. Particularly, businesses located in the south and southeast of VROMI yard will be affected by increased traffic, dust and noise by the move and operations of the two commercial entities
- **Air Quality:** Activities will lead to a temporary decrease of air quality due to exhaust emissions, increase risk of fires and other emissions from the landfill
- **Odor:** Re-opening of landfill sections can lead to temporary increased odor nuisance, especially in areas where anaerobic layers are reworked
- **Dust:** Reprofilling and soil works will lead to an increase in dust formation, chiefly within site border
- **Roads and Traffic:** Increase heavy traffic is expected between the port facilities and the MSWDS and between the SWDS and IDS sides of the MSWDS
- **Noise:** The metal-scrap yard and rock crusher could emit up to 90 dB (~80 dB average), exceeding the 55 dB Close to main roads, in urban areas with some commercial activities limit within 60 m. Extra noise will also come from haul-trucks and any relocated crushers or shredders
- **Hydrology and water quality:** Reprofilling may temporarily raise leachate generation and sediment-laden runoff; once capped, infiltration – and thus leachate – should fall by >80 %. Storm-water channels and vegetation will further cut sediment loads
- **Ecology:** Building the ring dike will clear existing mangroves, but compensatory planting can successfully reestablish mangroves on a like for like basis. Reduced leachate discharge should improve pond ecology over time. Importing large soil volumes carries a risk of invasive (soil) biota
- **Worker health & safety:** Main hazards are contact with sharp or contaminated waste, dust, occasional fires, steep working slopes, heavy machinery and drowning near water. Traffic between port and site adds accident risk
- **Public health & safety:** Residents may experience more dust, odour and traffic hazards during construction; vermin patterns could shift. Fire outbreaks remain a short-term concern until capping is complete
- **Aesthetic effects and Archaeological, Historic and Cultural Heritage impacts:** Final grassed slopes will enhance the landscape relative to the current situation. The ring dike encroaches

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slightly on historic salt-pond area and may lead to the loss of small sections of the walls designated as national monuments

- Natural disasters: Closed slopes remain vulnerable to major earthquakes much like surrounding structures. The ring dike and changes in surface run-off are expected to result in a maximum 2.6 cm rise in peak flood levels during high intensity rainfall events

The key impacts predicted during the operational phase are:

- Dust: Activities of two commercial entities will continue in the current VROMI yard, potentially resulting in an increase in dust emissions
- Noise: As the two entities manage the metal-scrap yard and rock crusher, their activities could emit up to 90 dB (~80 dB average), exceeding the 55 dB Close to main roads, in urban areas with some commercial activities limit within 60 m. Extra noise will also come from haul-trucks and any relocated crushers or shredders
- Increased traffic: Two entities will use an existing unpaved public road as an access road to VROMI yard. The increased heavy traffic may affect residents and businesses along the road
- Soil and groundwater: Activities of two commercial entities can impact to soil and groundwater quality due to spills in operating processes

Stakeholder engagement and communications plan

The objectives of the stakeholder engagement and communications plan are to guide the open, respectful dialogue throughout the design, construction and closure phases. The stakeholder landscape consists of government, funders/proponents, site owners/operators, three affected entities, and directly affected public as well as the wider community and media.

Proposed engagement tools used are:

- Local press, radio, TV, social media and project website for broad disclosure
- Topic-specific meetings and outreach sessions
- Two-way channels adapted to stakeholder preferences

Stakeholder outreach and consultations are ongoing. Public consultation was held on Wednesday, September 3, 2025 at the Belair Community Centre with nearly 200 people in attendance.

Grievance Redress Mechanism (GRM)

NRPB has a functional GRM. All grievances related to NRPB projects, including planned landfill activities under EDMP, can be filed in-person and by phone, e-mail, or NRPB website:

NRPB website: [Complaints Procedure](#) (including on-line complaint submission form)

Telephone: +1(721) 542-8886/7

E-mail: complaints@nrpbxm.org

In-person: National Recovery Program Bureau (NRPB)
#57 Walter A. Nisbeth Road
Philipsburg, Sint Maarten

0.5 Environmental and Social Mitigation Measures and Instruments

Environmental and Social Mitigation measures and instruments are indicated in [the Environmental and Social Management Plan \(ESMP\)](#).

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Economic impacts arise from the project's requirement to relocate two companies, Steel Crushers B.V. and Windward Roads B.V., along with the Sint Maarten Soccer Association's long lease land used for landfilling. Proposed mitigation measures include providing alternative land and compensating for cost of move, temporary income loss during the transition process, temporary loss of income after relocation and any other impact identified during the preparation of the A-RAP.

Air quality is expected to be affected during the re-profiling of the landfill and construction activities, as it will generate dust and mobilize various air pollutants. Mitigation strategies involve maintaining construction equipment, scheduling work during daylight hours, and implementing dust suppression techniques to minimize air quality impacts.

Traffic management is essential as an increase in traffic is anticipated due to movements between the port and landfill. Traffic management will be implemented to mitigate impacts including traffic controls measures on Soualiga Road between IDS and SWDS entrance sections, speed restrictions and spotters at sensitive passages on the route from Port of the MSWDS and road inspection for damages.

Noise pollution is another consideration, as the relocation of facilities and increased traffic are likely to raise noise levels in the area. Mitigation strategies include adhering to noise standards and constructing barriers to reduce noise pollution between main point sources of noise and key off-site receptors.

Soil quality preservation will be prioritized by ensuring that any imported soil meets or exceeds existing soil quality, and by preventing the introduction of non-native species into the area through biological and chemical control of quality of imported soil.

Hydrogeology and surface water quality will be safeguarded by the permanent erosion control integrated into the design of the works, and integrating temporary berms and run-off collection ponds during the construction period. Regular monitoring of water quality will be required during construction to demonstrate that the measures are working.

Ecological considerations will be addressed through ongoing biological surveys to monitor local flora and fauna, alongside efforts to re-establish all mangrove vegetation along the ring dike to support biodiversity. Contractors will work with species specific mitigation measures.

Worker health and safety will be ensured by adhering to local legislation and establishing a minimum working age of 18, thus protecting workers in potentially hazardous environments.

Public health measures will promote community engagement and transparency regarding project impacts, with information provided to the public about air emissions and other concerns. Aesthetic improvements will focus on greening non-operational areas and maintaining the visual integrity of the GSP's salt pans to enhance the landscape, as well as the cultural and historical significance of the area.

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Natural disaster risk mitigation will prioritize landfill stability and maintaining the buffering capacity of the GSP during flood events.

During operation phase, key mitigation measures for the operations by two resettled businesses in VROMI yard would include the following. The mitigation measures will be further refined by the site plan to be carried out by VROMI/NRPB.

- Noise. Noise barriers will be installed in the south of VROMI yard, in addition to operating hour restrictions enforced by hinderance permits
- Soil protection. Soil protective measures, such as oil collection slope, will be installed for the metal crusher
- Increased traffic. Speed and operating hour restrictions will be enforced by hinderance permits to be issued by VROMI prior to resettlement
- Stockpiling. Hinderance permits will restrict the height of stockpiles in VROMI yard to ensure community health and safety

1 Introduction

Sint Maarten struggles with a weak municipal solid waste management system. The responsible Ministry of Public Housing, Spatial Planning, Environment and Infrastructure (VROMI), although substantial improvements in operational management have been implemented over the past 5 years, the landfill continues to operate a subpar waste management and disposal system, while a related framework for the financial and governance setup is lacking. Since the start of its operation in the 1970s, the Solid Waste Disposal Site (SWDS), and later the Irma Disposal Site (IDS), both situated at Pond Island in Philipsburg and collectively referred to as the Municipal Solid Waste Disposal Sites (MSWDS), operate without a legal and regulatory framework and serve as an open dumpsites for the whole country with limited supervision, operational workflows, waste measures and controls.

In response to the destruction caused by hurricane Irma in 2017, the Government of Sint Maarten initiated the National Recovery and Reconstruction Program, known as "Building Back Better". This program aims to facilitate the island's large-scale recovery and reconstruction efforts. A significant portion of the funding is provided through a single donor Trust Fund established and endowed by the Netherlands and administered by the World Bank. The majority of the projects funded by this Trust Fund are managed and implemented by the National Recovery Program Bureau (NRPB), which serves as the Project Implementation Unit (PIU) for Trust Fund projects.

One of the projects supported by the Trust Fund is the Emergency Debris Management Project (EDMP). This project aims to effectively manage debris resulting from the hurricane and reconstruction activities, as well as to improve the organization, rehabilitation, and upgrading of debris storage and municipal disposal sites.

As part of the EDMP, a project was developed by the NRPB for conducting a Feasibility Study and Development of Procurement Document for the Rehabilitation and Closure of the Municipal Solid Waste Disposal Site (MSWDS) in Philipsburg, Sint Maarten. The aim of this project assigned to

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the consortium of Witteveen+Bos and TAUW is to develop a sustainable solution, including a Concept Design and associated Procurement Documents for implementation, for the SWDS and IDS in compliance with Environmental, Social, Health and Safety requirements and to establish sufficient landfill disposal capacity during the country's transition period to a non-disposal Integrated Solid Waste Management System.

Document Purpose and Scope

This Environmental and Social Impact Assessment (ESIA) report analyses the direct and indirect impacts of the proposed project activities on local communities, businesses, and natural resources until final reprofiling and closure of the MSWDS. This solution involves operating within the existing site footprint, implementing surface water management, collection and treatment of landfill gas emissions, while also facilitating waste management facilities for future recycling activities. The appointed Design + Build (D&B) contractor will work within defined spatial boundaries performance specifications and will update this ESIA as necessary to reflect the final approved design and construction methodology. The revised ESIA will ensure that any proposed modifications do not introduce new significant impacts or a worsening of the significant impacts identified in this assessment, and it will outline any new or modified mitigation measures that the D&B contractor will implement accordingly.

This report assesses the project activities to determine any direct and indirect impacts between these activities and nearby communities, commuters, businesses and natural resources. The content and extent of the environmental and social impacts which needed to be addressed in this ESIA have been identified through field testing, research and scoping, meetings and consultations. The ESIA also predicts and quantifies, to the extent possible, the magnitude of impacts and risks. This ESIA has built on the ESIA prepared in 2023 for the Installation of a Temporary Weighbridge and Reconstruction of the Access road to the MSW Site, Daily Management of the MSW Site Operations including Fire Suppression and Slope Recontouring ([ESIA Sint Maarten Emergency Debris Management Project. P-167347. NRPB, January 31st, 2023](#)), to reflect the current proposed scheme.

The following studies, plans and reports have contributed to the preparation of this ESIA:

- Air Screening Results For Pond Island Municipal Waste Disposal Site and Temporary Debris Site (Vol. 1 of 2) 2018: Overview (English). Washington, D.C.: World Bank Group. <http://documents.worldbank.org/curated/en/282681544798409196>
- Air Screening Results for Pond Island Municipal Waste Disposal Site and Temporary Debris Site International Advisory Support for Debris Management and Short Term Solid Waste Priorities for the Hurricane Irma Reconstruction, Recovery and Resilience Program Sint Maarten World Bank. Project Number: 2018-4191. EE&G Disaster Response, LLC, December 13th, 2018 (DRAFT)
- Landfill Operational Improvements and Debris Site Closure – Sint Maarten. SCS Engineers, January 2019
- Baseline Environmental Site Assessment - salt pond island – “blue box” zone along soualiga road and adjacent to the Municipal Solid Waste (MSW) landfill and Irma Debris Site (IDS)

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- Short Term Plan, Pre-feasibility Studies for MSW Landfill Upgrading & Extension and Integrated Solid Waste Management Facility (ISWMF). AIM Texas Trading, February 17th, 2020
- Resettlement Action Plan (RAP), RINA Consulting Inc. and National Recovery Program Bureau, 25th of August 2022
- ESIA Sint Maarten Emergency Debris Management Project. P-167347. NRPB, January 31st, 2023
- Moving to Integrated Solid Waste Management on Sint Maarten (ISWM-SXM). VNG International - October 15th 2023
- ESMP Sint Maarten Emergency Debris Management Project. P-167347. NRPB, December, 2023
- Environmental Field Survey Report. Reference R002-1293149ABR-V03-mvg-NL, Witteveen+Bos and TAUW, November 28th 2024
- Geotechnical and Geographical Survey Report. Reference R003-1293149GMC-V01-mvg-NL, Witteveen+Bos and TAUW, January 10th 2025
- Methane gas model calculations for the MSWDS, Philipsburg, Sint Maarten, TAUW note N002-1293149ABR-V01-rlk-NL, d.d. January 15th 2025
- Feasibility Criteria and Boundary Conditions, TAUW report R004-1293149IKR-V01-mvg-NL, February 21, 2025
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- Waste Generation, Composition and Disposal Note, Witteveen + Bos, 144046/TN/25-002, April 7, 2025
- Feasibility Study Report, Witteveen + Bos, Ref. 25.010-309, 4 July 2025
- Feasibility Study Addendum Report, Witteveen + Bos, 144046_25-015.875, 12 November 2025
- Assessment of Buffer Capacity Great Salt Pond, TAUW R009-1293149GMC-V01-tsz, December 2, 2025

Document structure

In this document, the structure of the original 2023 ESIA has been largely maintained. Information from the original ESIA has been incorporated and updated where new data has become available. Chapter 1 provides general background on the site, followed by an overview of the legal and regulatory framework in Chapter 2. The environmental and social baseline is presented in Chapter 3, and an overview of project alternatives is included in Chapter 4. The assessment of environmental and social impacts is provided in Chapter 5. The document concludes with the stakeholder engagement plan in Chapter 6 and the outcomes of the public consultation in Chapter 7.

1.1 Solid waste management in Sint Maarten

Sint Maarten has over 43,200 permanent residents and 2.4 million visiting tourists per year resulting in a reported per-capita solid waste generation of 9.7 kilograms per day. There are some National Ordinances and policies aimed at protecting and preserving the environment from

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pollution and degradation in Sint Maarten. However, it appears that these legal instruments are not fully enforced.

Solid Waste collection and sanitary landfill management are performed under the National Ordinance, known as the Waste Ordinance AB 2013, GT No. 135. The Ministry of VROMI manages solid waste collection and disposal services through a series of private sector contracts. No fee is charged for these services for residential properties whereas commercial properties typically hire private sector waste collection/removal services.

VROMI is also responsible for the processing and disposal of solid waste at the MSWDS, located on the landfill in the GSP in Philipsburg. Vehicles with license plates from the Dutch side of the island are permissible to enter the site, which is the only restriction currently in place. To improve the processing and disposal of solid waste, a fixed disposal fee is expected to be implemented as of 2025 for delivery of wastes to the MSWDS.

All collected solid waste of Sint Maarten is disposed at the SWDS and IDS with the IDS side of the site used for disposal of bulky green wastes and construction wastes and all other wastes directed to the SWDS.

1.2 Description of the Municipal Solid Waste landfill: Collection and Management

1.2.1 Operational practices

The Ministry of VROMI provides regular residential waste collection services to residents of Sint Maarten. Several private waste hauling contractors hold contracts with VROMI to collect and haul the waste in different areas of Sint Maarten. Residential municipal solid waste is brought directly to the SWDS/IDS sites for disposal. The island does not have transfer stations. Commercial waste collection services are provided by private haulers and the waste is disposed of at the SWDS/IDS. There are no recycling services offered by VROMI and recyclable materials are mixed with municipal solid waste unless the material is recycled with a third party.

1.2.2 Landfill design and construction

There are no available construction plans, details, or cross sections from the construction of the SWDS/IDS. Based on the gathered soil data during the current project, it is assumed that a system of walled sections, using locally available large boulders, and very similar to the set-up used for the construction of the salt pans, were filled with beach sand before landfilling in the area commenced, Google Earth pictures seem to confirm this set-up (see Figure 1.1).

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Figure 1.1 Infilling of Southwestern part of the landfill. Source Google Maps – picture date 16-06-2005

Using the available measurement tools in QGIS, the SWDS and IDS landfill cover a surface area of approximately 162,000 m² and 57,000 m² respectively. The documents present data from 8 more sections (in addition to the 8 existing ones), the geometry study that identifies zones by type of waste and the results of the characterization of the waste by means of trial pits. 10 trial pits were realized in SWDS and 5 in IDS.

A general SWDS profile is composed of a surface layer of fine sands covering a depth of 40 to 1.3 metres, depending on the area, followed by layers of different types of wastes. On the other hand, the general profile of IDS is composed of a surface layer of fine sands mixed with construction and demolition debris, plastics or other elements, the wastes at the IDS side consist of construction wastes mixed with bulky green wastes. Significant layers of ash are present at greater depth and temperatures in these layers are still high.

The distinctions in the type of wastes disposed resulted in distinct areas that can be identified (see table and image below):

- Irma Disposal Site (1)
- Steel Crushers B.V. (2)
- Tire waste disposal area (3)
- Construction wastes area (4)
- Cable burning area (5)
- Drainage channel (6)
- Older wastes area – ongoing reclamation (7)
- 2024 disposal area on old ring dike (8)
- Central area on SWDS side (9)

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- Windward Roads B.V.

Table 1.1 Geometry of the SWDS (including divided sections) and IDS in August 2024. Source: R003-1293149GMC-V01-mvg-NL

Area	Maximum height 2024 [m]	Area [m ²]	Volume (above surface water level Great Salt Pond) [m ³]
Irma Disposal Site (1)	20	57,000	490,000
Steel crushers (2)	0	7,200	0
Tire waste disposal area (3)	18	10,000	150,000
Construction wastes area including the Windwards Roads area (4)	30	25,000	465,000
Older wastes area (7)	30	40,000	750,000
Central area on SWDS (9)	42	37,000	980,000
2024 disposal area on old ring dike (8)	18	27,000	245,000
Other (area surrounding tire and construction waste area)	13	25,000	205,000
Total area	42	226,200	3,270,000



Figure 1.2 Current landfill lay-out with the approximate project boundaries (excluding Soualiga road) in red

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The topographic layout and cross sections of the SWDS/IDS presented in the ESIA (2023) were updated in the studies carried out in the Geotechnical and Geographical Survey Report (2025). The comparison is shown in the Figure 1.3.

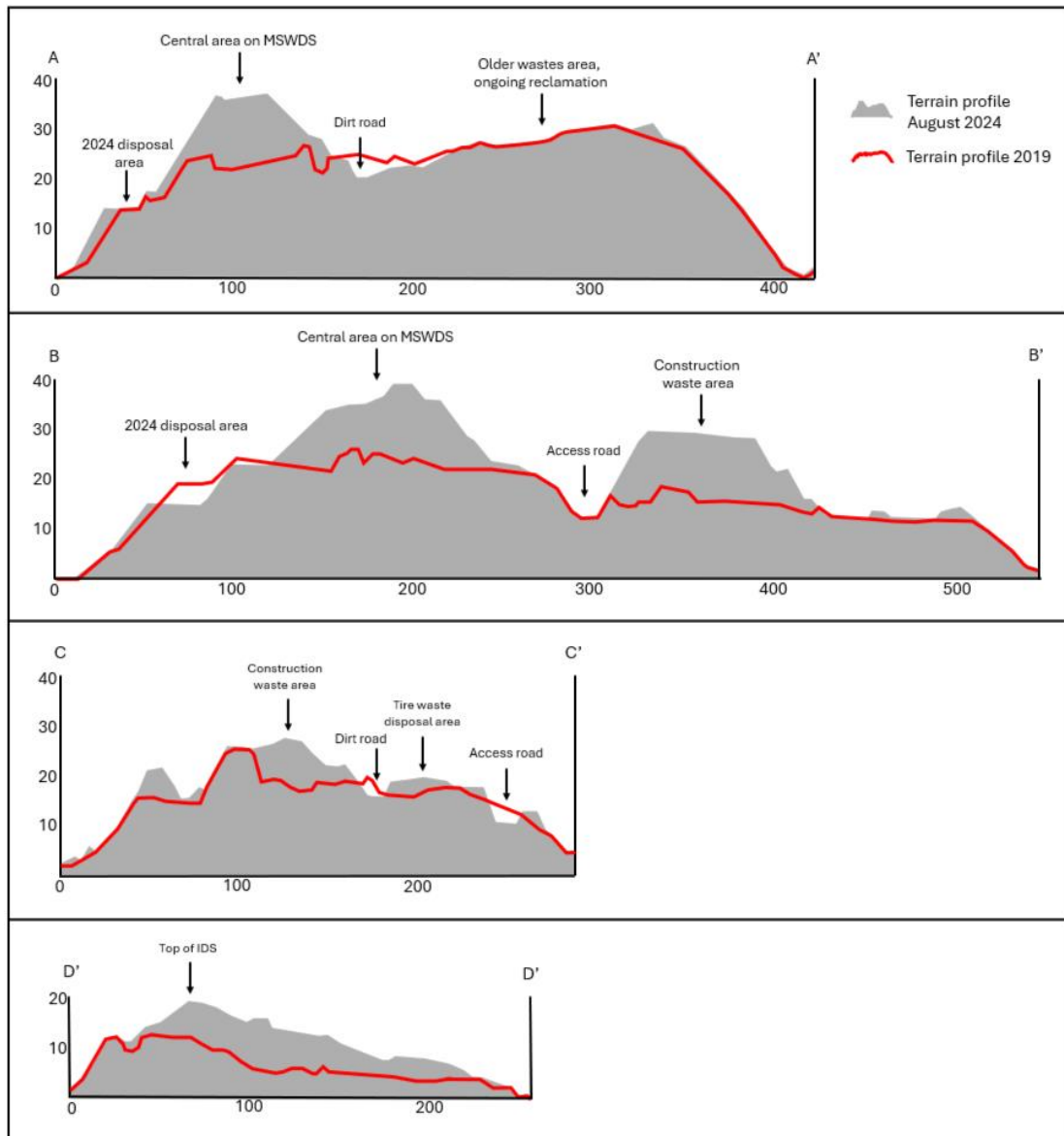


Figure 1.3 Cross sections from depicting the differences at the landfill between 2019 and August 2024. The red line shows the 2019 terrain profile

The new Digital Terrain Model (DTM) of the landfill presented in the Geotechnical and Geographical Survey Report shows that the landfill has increased significantly since 2019. The sharpest increase in size is located at the central area on the SWDS where the maximum height has increased up to 42 meters. The IDS expanded as well to a maximum height of 20 meters.

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For more details, see the Environmental Field survey Report (R002-1293149ABR-V02-mvg-NL, Nov. 2024) and the Geotechnical and Geographical Survey Report (R003-1293149GMC-V01-mvg-NL, Jan. 2025).

1.2.3 Landfill Organizational Structure and Staffing

Presently VROMI manages and operates the SWDS and IDS assisted by Heavy Equipment Contractors. There is no management plan in place. After restriction for the use of the Southern Area of the SDWS were imposed, due to lack of space, waste disposal has taken place on the old service road surrounding the SWDS, this has resulted in the service road no longer being available to access all areas of the landfill. On both the SWDS and IDS sides of the landfill, old sections are being reprofiled and compacted with new debris or waste followed by soil covering. At the MSWDS, there are 4 Heavy Equipment Operators with heavy equipment working and 2 contractors are on standby in the event of emergencies. In addition, Government contracts a part-time operator to operate machinery owned by Government (a Front Loader, Bulldozer). As of summer 2024, there was no longer any use of Alternate Daily Cover and imported materials from Saint Barts were used for daily cover. In addition, there is a number of Government employees working on site. The following is a list of equipment and personnel involved in management operations.

Equipment (interchangeable between the two sites):

SWDS

- Excavators
- Loaders
- 1 Compactor
- Bulldozer
- FORD F-350

IDS

- Excavators

Personnel for both sites:

- Supervisor
- Part time Contract Manager
- Persons security 24 hours per day 365 days a year at the SWDS
- Persons security 24 hours per day 365 days a year at the IDS
- 1 Security Supervisor (mobile unit)

Both disposal sites are open from 6:00 A.M. to 6:00 P.M. daily. On Public holidays the sites are open for half a day. Trucks entering drive to the designated dumping area and dispose of their waste or debris. The machinery levels the waste and debris and compacts it. Once or twice a week the area is covered with a daily cover. A Bulldozer is used to level and compact. A Loader moves the higher piles of waste to shorter piles and is used to transport fill from one location to the dump area. The Excavators keep re-profiling daily to create additional dumping space.

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In case a subsurface fire is detected on one of the disposal sites, heavy equipment operators are called in and storage fill/dirt is used to cover the area. If required a water pump is leased to soak the area for 96 hours minimum. Another mitigation strategy is the use of a VROMI water truck, which will source water from the Sewage Treatment Plant on A.T. Illidge Road. In case of a surface fire, depending on the emergency, Heavy Equipment Operators are called in and given specific tasks to combat the Surface fires. Mainly Fill/Dirt is trucked to the site to cover the surface fire. Depending on the situation, third party equipment is sourced, such as submersible pumps or additional heavy equipment. If needed the Fire Department is called in to assist.

1.2.4 Waste receiving operations

Waste content monitoring procedures in place were minimal, and the actual content and quantity of the waste that was being received was unknown. Municipal trash and waste, including tires were accepted at the SWDS side; and bulky debris, including vegetative debris, pallets, construction debris, white goods and other miscellaneous large items were accepted at the IDS. No specific separation or special handling takes place. The incoming waste was not weighed, tracked, or sorted, due to the lacking of a weighbridge. Incoming trucks are registered based on their license plates although this practice is from recent years only. The waste is compacted using an excavator and part of the operations focus on re-use of construction wastes for daily cover of the waste. A surplus of sandy materials was present on-site in the summer of 2024.

The SWDS and IDS are operated by the Ministry of VROMI, based on the National Decree on the organization of the Ministry of VROMI. Certain companies have access because they are contracted for heavy equipment, concrete crushing and security services. The sites remain accessible for all vehicles with Sint Maarten license plates and waste disposal is allowed during opening hours. No formal access is granted to conduct waste picking activities and/or collection of recyclables, and 24/7 security is in place.

1.2.5 Daily soil cover

Sint Maarten does not have a source on the island for cover soil; therefore daily cover was not consistently used at the IDS and SWDS Site. VROMI obtains dredged clay and sediments from St. Barths as well as excavated soil for use as daily cover and to extinguish surface fires at the SWDS/IDS. VROMI excavates and processes parts of the older landfill areas where large quantities of construction wastes have resulted in a high admixture of sand and rocks within the wastes. The rocks are sold whereas the sand is used for daily cover.

1.2.6 Fire and slope stabilization at the SWDS/IDS

Surface and subsurface fires were reported to have been present at the MSWDS prior to Hurricane Irma (2017). Shortly after placement of the initial debris from Hurricane Irma, an increase in the surface fires and evidence of subsurface smoldering fires were identified at the SWDS. In addition, surface fires and evidence of subsurface smoldering fires were identified at the IDS in the months following the opening of the deposition site. The Ministry of VROMI attempted to extinguish fires by dousing them with water from the GSP and covering them with layers of dirt/soil, up to approximately 30 to 140 cm thick. This technique was effective in extinguishing the surface fires, and the majority of subsurface fires. Although the efforts of VROMI appeared to have

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abated the surface fires, the proximity of the residences and commercial businesses to the SWDS/IDS was identified as a concern due to aforementioned potential exposure of people to harmful substances, (exacerbated by) fires and potentially unstable side slopes.

1.2.6.1 Subsurface fires

Evidence of subsurface fires have been historically identified at SWDS Site. Shortly after Hurricane Irma an increase in the surface fires and evidence of subsurface smouldering fires occurred at the SWDS. The high temperatures generated by the subsurface smouldering may result in air emissions that can potentially contain chemical compounds or constituents of concern, (COCs) from materials melted or combusted by the fire. Some of these are known to be harmful to humans at certain concentrations and exposure thresholds. These emissions have the potential to be harmful to the population in the vicinity of the SWDS/IDS and those residing in areas which may be affected by smoke associated with landfill fires.

Air quality monitoring data that has been collected to date has demonstrated that there are no concentrations of COCs at levels that would warrant health concerns beyond the perimeter of the SWDS/IDS. However, testing has not been performed during active surface fires where visible emissions (black smoke) would tend to indicate that a significant concern could exist in these specific conditions.

In January 2020, EE&G and Hammer Consulting, at the request of World Bank and the NRPB, performed a limited site visit to review the conditions at the SWDS/IDS. During the site reconnaissance, the following observations were made:

- Active surface fires were not observed
- Evidence of active subsurface fires were observed on the northwest and southeast portions of the SWDS Site. The subsurface fires observed on the northwest of the SWDS Site were located approximately 200 m northwest of the community, and the submerged fires located on the southeast were approximately 60 m west of the community. Using available prevailing wind direction information, both were located generally downwind of the community. The community within the Resettlement Area of Impact (RAI) has since been relocated, closest residential areas are now 150 m upwind of the South East Area of the SWDS. The situation pertaining to subsurface fires remains fluid as VROMI continuously addresses occurring hot spots when identified (see above).

1.2.6.2 Slope stabilization

In 2018, it was observed that some of the side slopes of the MSWDS were too steep, with slopes approaching 1:1 and potentially unstable (A typical landfill side slope is graded at a slope of 3 meters horizontal (3H) to 1 meter vertical (1V). This is represented by the term 3:1.). In addition, continuous subsurface fires had caused cracks or fissures to form on the surfaces of the SWDS, which in turn can be related to subsurface instability. Based on visual observations and a desk study, a 'no work' zone was implemented on the South-Eastern part of the SWDS.

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The Geotechnical and Geographical Survey Report (R003-1293149GMC-V01-mvg-NL), carried out in January 2025, updates the information on the geotechnical characteristics and stability of the SWDS and IDS.

The maximum height of the SWDS is 42 meters and IDS 20 meters (status of August 2024). Waste volumes calculated from the Digital Terrain Model (Figure 1.4) gives a volume of approximately 2.8 million m³ for the SWDS and 490 thousand m³ for the IDS. This is the estimated waste volume present above the surface water level of the GSP.

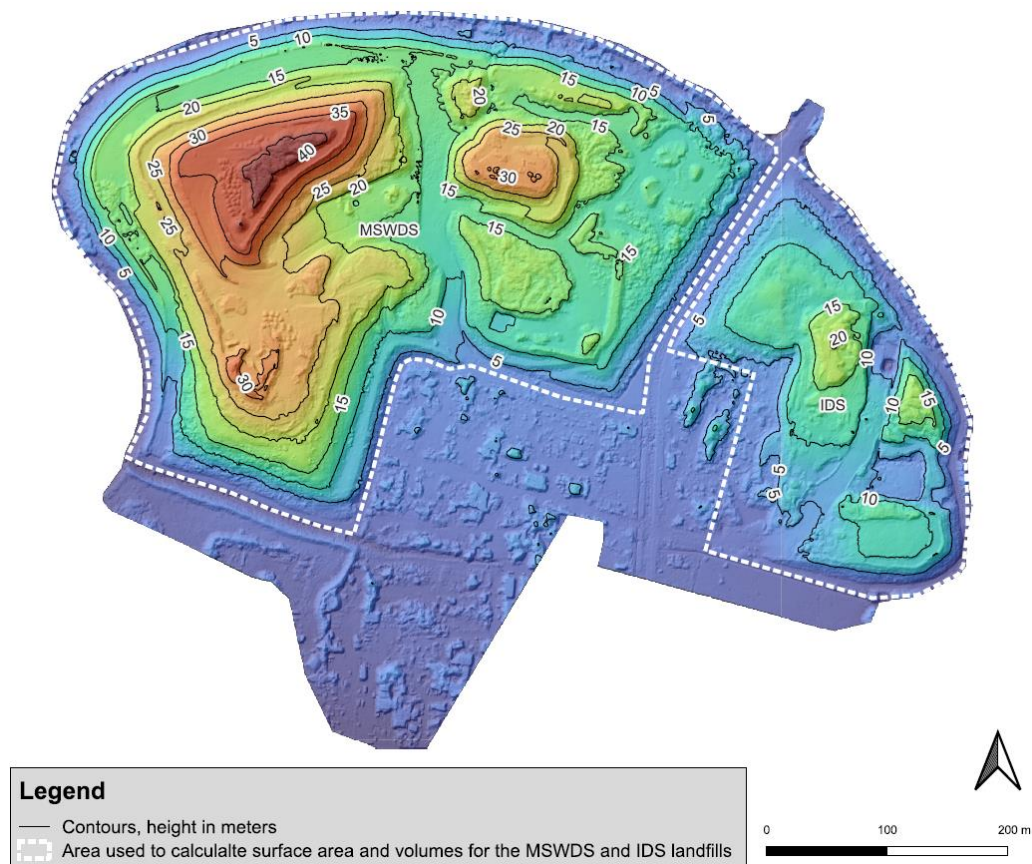


Figure 1.4 Digital Terrain Model (DTM) 2024 with the SWDS and IDS sections (status August 2024)

Eight (8) profiles of the landfill, are obtained from the DTM data. These profiles are seen as representative for various sections of the landfill. From each section (older waste area, central area of SWDS, construction waste area and IDS) a profile is generated and is chosen at locations with steep slopes. The slope stability in the current situation is analysed for these 8 profiles.

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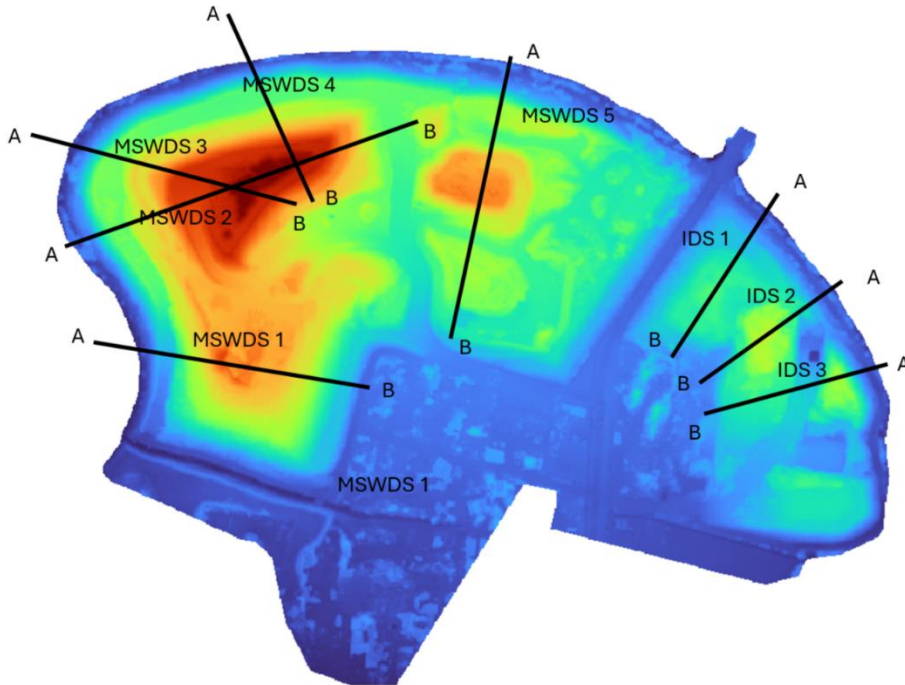


Figure 1.5 Geometry for slope stability analyses (status August 2024)

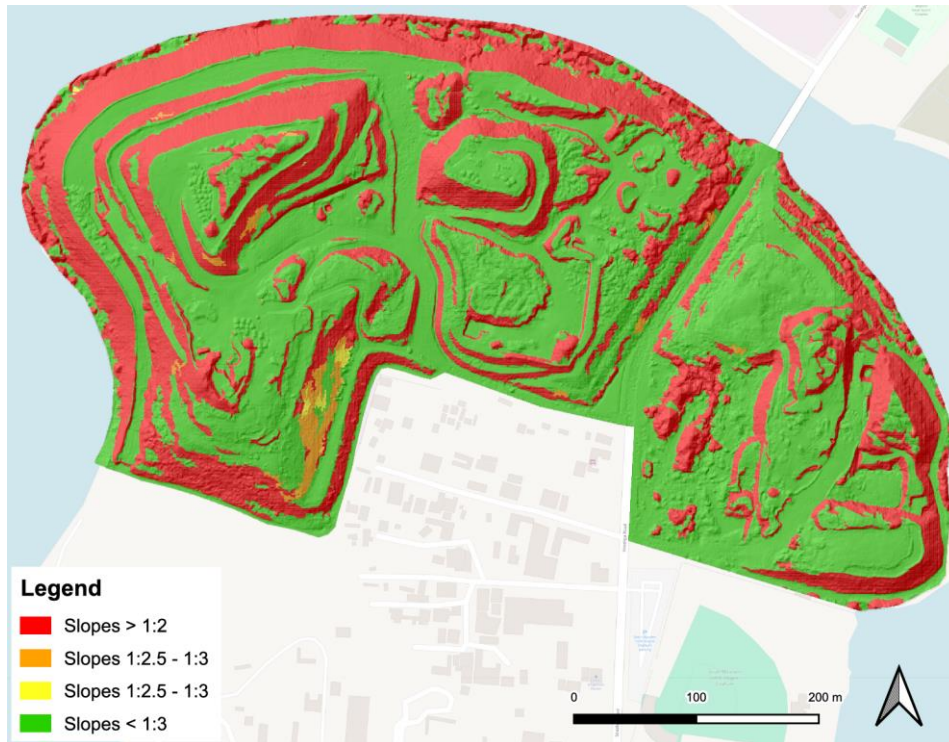


Figure 1.6 Categorized slopes at the landfill (status August 2024)

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The stability analysis of the landfill in the current situation shows that the slopes of the landfill (on average steeper than 1:2) are not stable. In cross-sections MSDW3, MSDW4, MSDW5 and IDS3, there is a risk of macro instability; deep shear planes arise through the clay silty layer underneath the landfill. A design of a berm/shoulder could enhance the macro stability of the landfill.

Based on the available data, during an earthquake, the clay silty layer could lose its strength and long slip circles underneath the landfill could form in this layer. In the case of an earthquake, an unrealistically faint slope is required to remain stable. To remain stable, an alternative design, such as a shoulder or berm or a stepped slope, should be considered.

The probability of an earthquake occurring in this area is generally much lower than the probability of extreme rainfall. In other words, since earthquakes are less frequent, an even smaller safety factor may be allowed. This could lead to an optimized design with fewer modifications to the current profile.

For more details, see the section 6 in the Geotechnical and Geographical Survey Report (R003-1293149GMC-V01-mvg-NL), carried out in January 2025.

1.3 Environmental Matters and Recent Social Studies

1.3.1 Community Resettlement

In August 2018, an assessment on fires and structural conditions of the SWDS/IDS was performed (Project Number: 2018-4191. EE&G Disaster Response, LLC, December 13th, 2018). Based on that assessment, two safety zones were designated with the primary safety zone due to the steepness of the slope located immediately to the west of the future resettlement area of impact and its anticipated proximity to fire suppression activities. The secondary safety zone was described as a 'notification zone', whereby businesses and residences would be notified of the fire suppression activities and be prepared to evacuate if necessary.

To ensure community safety, NRPB developed and implemented [The Sint Maarten Emergency Debris Management Project's Resettlement Action Plan \(RAP\)](#) (August 2022 - [Resettlement Action Plan \(RAP\)](#)) to relocate residents of the inside the primary safety zone. This included the resettlement of 143 Project Affected Persons (PAP) including 104 individuals, 32 business owners, 5 employees and 2 waste pickers. Most PAPs opted for cash compensation, with only six families choosing replacement housing. All PAPs received their cash compensation, and six families opting for in-kind compensation received permanent housing. The RAI structures were demolished, and the site was handed over to VROMI in June 2025. NRPB completed RAP implementation in September 2025.

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Figure 1.7 Resettlement Area of Impact, from RINA Consulting Inc. and National Recovery Program Bureau, P. 167347, August 25th 2022)

NRPB also prepared a [Livelihood Restoration Plan](#) to support vulnerable PAPs (i.e., female heads of household, waste pickers, and employees) and businessowner PAPs to restore their livelihoods and wellbeing and offer transition measures, in particular, for waste pickers. The support included skills training, internship, job placement support, English courses, immigration support, etc. The LRP implementation was completed in May 2025.

1.4 Description of the Project Activities

To support Sint Maarten’s recovery through management of debris from the hurricane and reconstruction activities and to facilitate recovery and reduce risks, the project will focus on the following activities:

1.4.1 Proposed activities

The key activities at the Philipsburg MSWDS are:

- SWDS Slope recontouring and closure including slope stability improvement
- IDS recontouring and closure
- Installation of auxiliary buildings

Contrary to the original ESIA (Jan 2023), daily landfill management of the SWDS and associated Fire Suppression activities are no longer part of this ESIA as these activities have been decoupled from the MSWDS redesign and are no longer included in the proposed project activities. It should be noted that landfilling and fire suppression activities are expected to continue by third parties.

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Any fires caused by direct actions of the DB contractor will need to be controlled by the DB contractor as part of Environmental Health & Safety (EHS) management.

1.4.2 SWDS Slope recontouring and closure including slope stability improvement

The existing waste mass will be reprofiled for stable slopes and levelled to a height of 36m for the SWDS and 24m above Sint Maarten Peil (average sea level) for the IDS. Associated activities, including the weighbridge will be moved within the set-back zone of the SWDS, the resettlement area and VROMI yard. The landfill entrance road will be moved slightly South of the existing road, within the current RAI area. To ensure slope stability and limit volume loss due to oblique corners of the current landfill, a small section of the RAI area will be included in the new SWDS disposal area. It is expected that the IDS side is closed permanently after a construction period of ~60 weeks. The SWDS is expected to be closed permanently ~52 weeks after landfilling operations cease. The draft implementation schedule is included in Appendix 4.

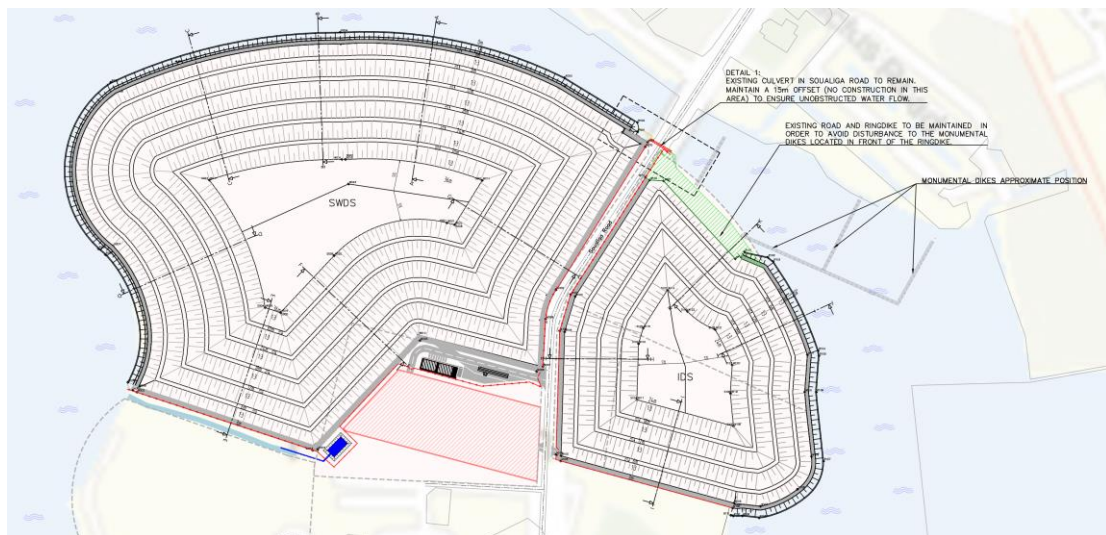


Figure 1.8 Landfill design with contractor yard in red

Slopes regrading, roads, fencing and stormwater management

The Geotechnical Survey (R003-1293149GMC-V01-mvg-NL) and associated assessment indicates that both the IDS and the SWDS currently have an instability on both macro and micro slope scales. This instability is primarily attributed to the poor geotechnical strength of the geological base, in combination with the steep slopes and the considerable weight of accumulated waste. As such this results in a risk of sliding of the slopes.

In addition, there is a significant risk of macro-scale failure in the landfill in the event of an earthquake, stemming from the unstable basal structures. Completely eliminating the risk of geotechnical failure in the event of an earthquake would necessitate either a very long toe or substantial subsurface strengthening, which are not considered feasible due to spatial constraints and neither considered cost efficient. The potential for macro slope failure under earthquake conditions is therefore considered unavoidable. However, the engineering solution with respect to

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geotechnical stability shall ensure that no risk exists on geotechnical failure under normal conditions.

Slope regrading

Based on the calculations a stepped elevation profile consisting of slopes with a height of 6m and a slope ratio of 1:3, in combination with flat benches with a width of 4m and a slope ratio of 1:20 in combination with a ring dike at the toe of the MSWDS bordering the GSP with a width of 4m (at surface level) and a slope ratio at surface level of 1:20 and geotechnical reinforcement of the entire slope from crest to toe at all sides of the MSWDS is sufficient to ensure geotechnical stability

Fencing

A 1.8m high mesh wired (max mesh 0.1m), including supporting poles and a manually operated sliding access gate at the entrance road, is foreseen at the landside of the SWDS and IDS to prevent uncontrolled and/or unauthorised access during its operational phase.

Stormwater management

The concept feasibility assumes a design for the stormwater from the surface of the MSWDS facing the GSP based on a direct discharge of the stormwater run-off into the GSP. A profile of 5 % towards the GSP is applied at the surface of the ring dike to prevent stagnation of the run-off and associated infiltration in the ring dike which would cause a potential risk for fluidizing the toe of the landfill impacting the geotechnical stability.

The concept engineering design for the stormwater from the surface of the MSWDS facing the landside is based on an indirect discharge of the stormwater run-off into the GSP through a Storm Water Drainage System consisting of pre-cast U-profile concrete gutters with direct discharge to the GSP.

Waste Reception and processing

While current waste collection contracts make allowance for segregated waste collection, no specific actions have been taken to pre-sort the wastes coming to the landfill as the facilities for processing are lacking. Existing plans for the Temporary Debris Storage & Reduction Facility (TDSR) have to date not been further developed.

NRPB launched a Request for Bid in the selection of a suitable Supplier to procure, deliver and commission a mobile crusher and shredder with the associated application hardware and software, and provision of operator training, for the purpose of processing the incoming waste to the landfill required by the landfill operator (VROMI). As of March 2026, no final bidder was selected yet.

A high-performance, universal waste shredder is required for on-site shredding of diverse waste streams. The shredder must be capable of handling a broad range of waste types including plastics, paper, glass, metals, wood, textiles, organic and yard waste, tires, bulky waste and light construction debris.

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Also required is a robust, high-capacity mobile jaw crusher engineered for demanding applications such as hard rock processing, and heavy-duty recycling. Its design emphases must be in robust construction and durability, in mobility, and ease of operation.

This equipment is mobile and will be operated by VROMI within the current boundaries of the MSWDS.

Interim and final cap

The feasibility design assumes a uniform engineering solution to be applied for the cover layer at the slopes upon closure of the SWDS and IDS. Based on the base-case where a synthetic permeability barrier is foreseen, the cover layer consists of the following elements (top down):

- Topsoil with grass vegetation (0.5)
- Geotechnical Reinforcement Structure (0.3m) filled with sand/gravel (0-40mm)
- Drainage Mat
- Synthetic Permeability Barrier (2mm LLDPE)
- Protective Geotextile (800g/m²)
- Support Layer (0.3m sand/gravel, 0-40mm), with high-dense vertical gas extraction incorporated at flat areas of slopes at SWDS)
- Profiled Waste Material

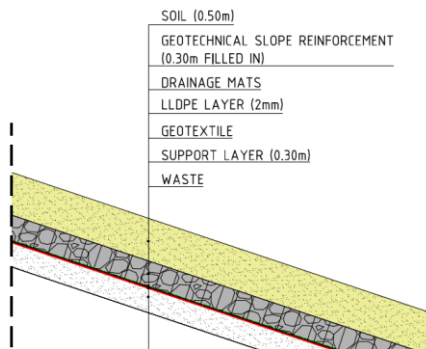


Figure 1.9 Total Overview Engineering Concept for Slope Cover Layer

Cover Layer at Crest

The feasibility design of the cover layer to be constructed upon closure for the base-case with a synthetic permeability barrier. This results in a cover layer consisting of the following elements (top down):

- Topsoil with grass vegetation (0.5)
- Sand/Gravel (0-40mm)
- Drainage Mat
- Synthetic Permeability Barrier (2mm LLDPE)
- Protective Geotextile (800g/m²)
- Support Layer (0.3m sand/gravel, 0-40mm), with gas drainage incorporated (horizontal passive extraction system at IDS, vertical active high-dense extraction system at SWDS)
- Profiled Waste Material

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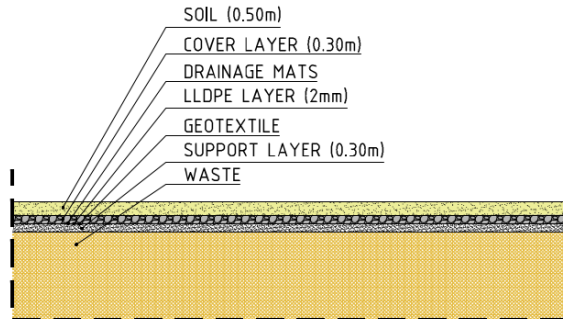


Figure 1.10 Total Overview Engineering Concept for Crest Base Case Cover Layer - IDS and SWDS

The recycling or re-use of waste is considered beneficial by the different stakeholders, as such, the design will include the sustainability of these resources, including their origin and availability to minimize environmental impact. In practice this would consist of the excavation of parts of the landfill, the sieving of the materials to separate soil and the crushing of construction wastes for re-use on-site. These operations already take place on the landfill in small scale.

The topcover shall be vegetated, which as a minimum, consist of grass covering the full surface of the soil cover layer. The composition of the soil cover layer and the climate conditions shall be considered for the selection of the type and seed density of the grass to be applied and the necessary preparation of the soil cover layer to ensure a swift rooting and growth; deep rooting (>0.3m) vegetation shall not be applied and preparation of the soil cover layer shall not be performed at a depth exceeding 0.2m from the top of the soil cover layer. The species to be seeded should be appropriate to the flora of Sint Maarten (i.e. be considered native and not introduce new or invasive species). The full surface covering vegetation shall be established with a matured growth within 13 weeks after the installation of the soil cover.

Landfill Gas Management

The feasibility engineering solution consists of a horizontal gas drainage incorporated in the support layer underneath the synthetic permeability barrier. A network of perforated HDPE gas drains (160mm) will be trenched into the support layer for gas relief to prevent accumulation. The network of perforated HDPE drains will be connected to a limited number of locations (3 at SWDS and 2 at IDS) that will pass through the entire build-up of the cover layer on the crest of the IDS.

The relieved gas collected through the passive horizontal drainage will be passed through a biofilter filled with compost material. Compost materials in general provide a high oxidation capacity for the methane oxidation thereby reducing the GHG emission. The biofilter should be designed for a volume of 900 m³/d and 600 m³/d at respectively the SWDS and IDS with an oxidation rate of > 60 %.

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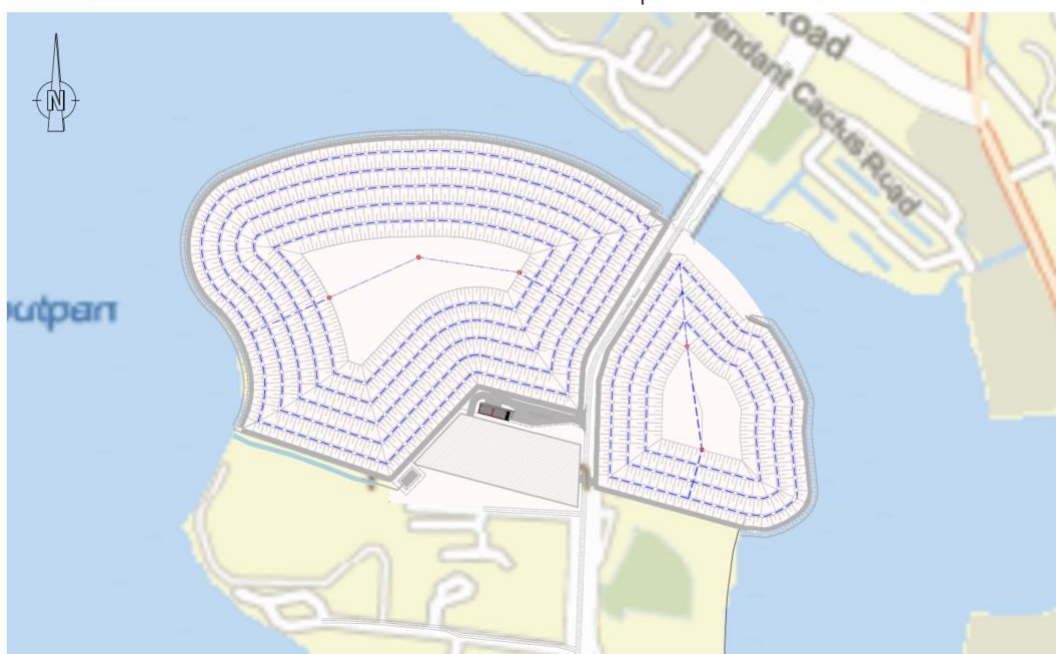


Figure 1.11 LFG network at SWDS and IDS with ring dike and service road shown in gray



Figure 1.12 Visualization of biofilters

Leachate Management

With respect to the (uncontrolled) discharge of leachate from the MSWDS into the GSP, the feasibility design measures are based on the reduction of leachate generation. No leachate treatment for the existing SWDS and IDS is envisaged as the leachate disperses from the base of the waste body and collection would not be technically and economically feasible.

Reduction of leachate generation is achieved through the installation of a permeability barrier in the cover layer upon closure of the landfill.

The engineering solution for the reduction of leachate generation is to be achieved by synthetic permeability barrier to be incorporated in the cover layer upon closure of the MSWDS.

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Figure 1.13 Permeability Barrier for Landfill Closure (Synthetic vs Mineral Barriers)

An engineering solution for the synthetic permeability barrier, consists of a LLDPE liner (2 mm) as synthetic permeability barrier. The selection of a LLDPE liner is based on its higher flexibility and lower puncture risk in comparison to a HDPE liner.

In order to install the LLDPE liner the waste mass is to be covered by a support sand layer (0.3m). A geotextile is to be installed between the support layer and the LLDPE liner to reduce the risk of damage of the liner. In order to collect and discharge infiltrated storm water accumulated by the permeability barrier, a drainage system is to be installed above the LLDPE liner which is integrated with the stormwater management system (i.e. drainage mats).

The strokes of LLDPE liner need to be welded together using special equipment by qualified personnel and tested for strength after installation to ensure the functionality of the synthetic permeability barrier.

Anchoring of the LLDPE liner by means of a soil cover at the toe of the MSWDS is anticipated underneath the service road and integrated within the ring-dike structure surrounding the full boundary of the MSWDS.

Ring dike

Accessibility is achieved through the 4m wide ring-dike to be constructed along the boundary with the GSP as part of the engineering solution for the geological stability, in combination with a 4m wide service road is foreseen at the landside of the MSWDS. Both the ring-dike and the service area will have a gravel pavement (0.3m top layer). The slopes of the ring-dikes will be covered with the existing rock-armour and (cultivated) juvenile mangroves suitable for the salt conditions of the GSP.

The ring dike will be constructed from recycled aggregate from C&D waste or in case of insufficient volume of recycled coarse aggregate crushed stones. The ring dike will boast a gravel pavement consisting of Recycled Aggregate to increase material re-use.

In order to avoid for erosion as a result of the stormwater run-off towards the GSP, a soil layer of 0.5m is to be constructed on top of the Base Construction at the slopes of the Ring Dike in order to allow for a natural development of general vegetation.

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The slopes of the ring-dikes furthermore require erosion protection against waves and currents in the GSP to avoid excessive damage. A slope protection is applied in the Concept Engineering Design, which consists of the re-use of rock armour from the existing Ring Dike in combination with mangrove vegetation. The rock armour removed from the Ring Dike will be evenly distributed to form part of the slope protection. The mangrove vegetation to be installed is not solely intended for slope protection against waves and currents but is also intended as compensation for the loss of mangrove vegetation at the existing Ring Dike. A Mangrove Restoration is therefore anticipated consisting of planting juvenile (red) Mangrove with a density of 1 per 0.8 m² along the Ring Dike.

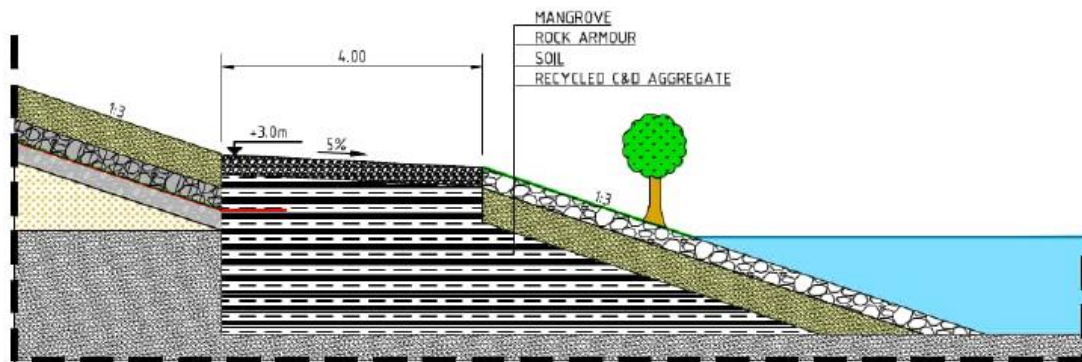


Figure 1.14 Ring dike cross-section with Stormwater gutter and maintenance road

Along the northern side of the SWDS and IDS, the ring dike will be moved slightly inland to limited blockage of existing culvert and encroachment of the Salt Pan structures. Figure 1.15 indicates these areas.

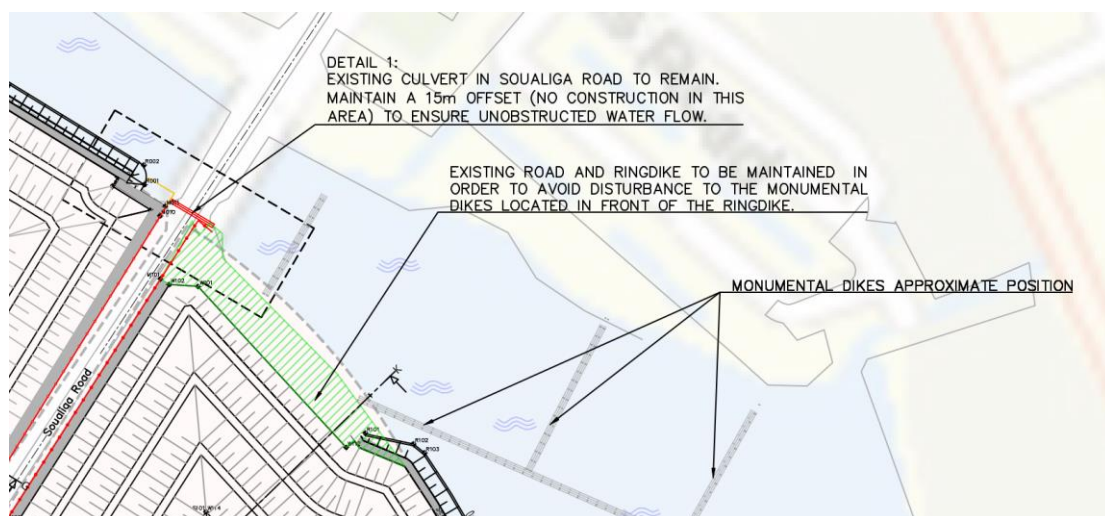


Figure 1.15 Details where existing ring dike shall be maintained

1.4.3 Irma debris disposal site recontouring and closure

No further waste disposal at the IDS is foreseen. The area currently used by Steel Crushers B.V. is needed to achieve the objectives of the project and hence, relocation of its activities to another

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suitable location (most probably the VROMI yard, see Figure 1.16) is required. The existing waste mass will be reprofiled for stable slopes and levelled to a height of 24m. Based on August 2024 estimates and continued landfilling since, it is expected that no positive net-balance remains at the time of reprofiling. If this is the case, the volume will be filled with construction and demolition wastes from the SWDS.

Slope regrading, stormwater management, leachate management, landfill gas collection and treatment, ring dike and final capping for the IDS are identical to the SWDS (see Section 1.4.2).

1.4.4 Installation and operation of auxiliary operations

The current VROMI yard will be used for auxiliary operations closely associated with the landfill operations under the Government of Sint Maarten's waste management strategy (Waste Vision 2050). The waste diversion will include the operations of Steel Crushers B.V. which operates a facility for collection and scrapping of metals (mainly cars) and Windward Roads B.V. (WWR) which operates a concrete crushing facility in the landfill. Steel Crushers currently operates in IDS, and WWR operates in SWDS (detailed in Section 3.1.3). The two entities will be resettled in VROMI yard.

In addition, the following auxiliary facilities will be installed:

- 4m wide service road on the landside of the SWDS and IDS consisting of recycled aggregate from C&D Waste (see Figure 1.11)
- Temporary Contractor Yard; area immediately south of the entrance of the SWDS with a size of approximately 16,000 m². Contractor can use the temporary Contractor Yard for the temporary location of its office facilities, storage of equipment and material, production and stockpiling of recycled aggregates from C&D Waste, et cetera (see Figure 1.17)
- Production of recycled aggregates; The Recycled Aggregates are to be recovered or produced from excavated C&D Waste (e.g. sand, soil, bounded ceramic material) deposited at the MSWDS. The C&D Waste will be sieved and crushed to meet the required particle sizing for the different types of construction applications. The crushing will be done using mobile machinery positioned with the current MSWDS boundaries based on future location and needs. Contamination of bounded non-ceramic materials will be removed prior to the crushing

The existing buildings and facilities currently located at the SWDS shall be relocated to the nominated area in the RAI.

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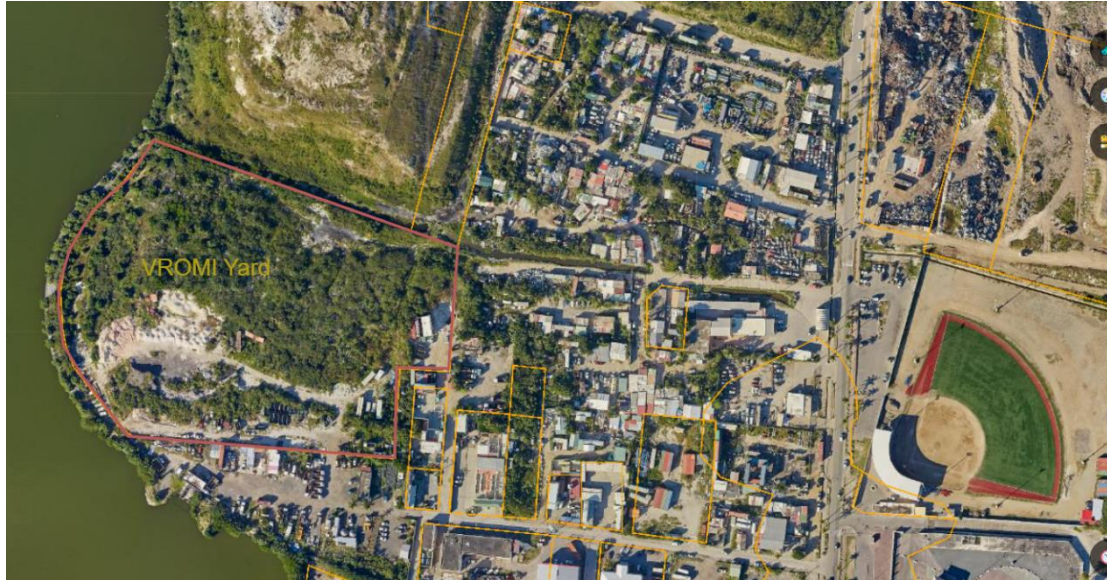


Figure 1.16 VROMI Yard, outlined in red, illustrates where WWR and Steel Crusher operations will be relocated

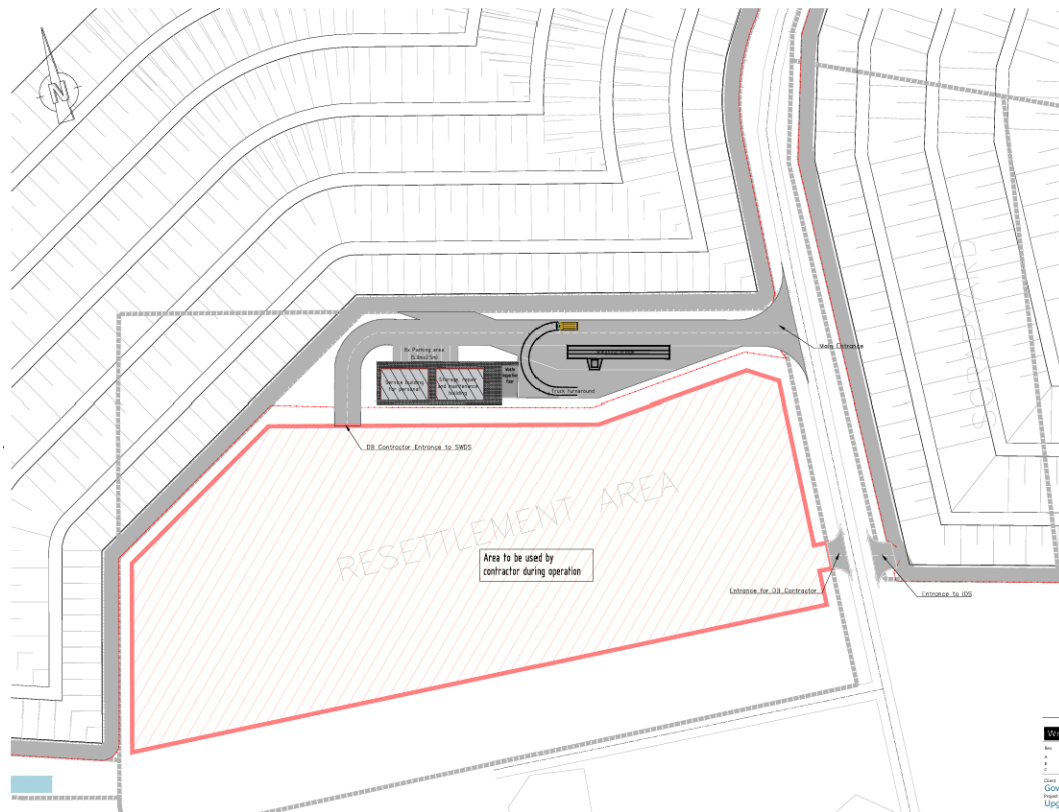


Figure 1.17 Propose site of existing buildings and contractor yard

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1.4.5 Production of recycled aggregates

The Concept Design is based on a maximum application of Recycled Aggregate from deposited C&D Waste for construction purposes. The Recycled Aggregates are to be recovered or produced from excavated C&D Waste (e.g. sand, soil, bounded ceramic material) deposited at the MSWDS. The total re-use of recycled aggregates from C&D Waste for construction purposes for the Concept Design Option with a limited extension of the SWDS into the RAI amounts to approximately 150 thousand m³, no import of aggregates is foreseen. The C&D Waste shall be sieved and crushed to meet the required particle sizing for the different types of construction applications; contamination of bounded non-ceramic materials shall be removed prior to the crushing. Apart from the C&D aggregates for construction purposes under the DB Contract, an additional volume of 3,700 m³ of shredded aggregates from waste tires deposited at the SWDS shall be produced for their application in the LFG drain trenches.

1.4.6 Sequence of works

The sequence for implementing the activities may be adjusted according to the preferences of the Design & Build (D&B) contractor. However, given the limited available space and the interdependence of the various tasks, the overall order of implementation is largely predetermined. A schedule is provided in Appendix 4.

Following site preparations and mobilization, reprofiling of the IDS and SWDS is expected to commence. During the initial months of this phase, wastes from the SWDS will be transferred to the IDS area. Construction of the ring dike is anticipated to begin approximately one to two months after the start of the reprofiling works. Installation of the top cover, the landfill gas management system, and the stormwater management system is not expected to occur until approximately 8–12 months into the construction period.

2 Legal, Regulatory and Policy Framework

The island of Sint Maarten, an autonomous country within the Kingdom of the Netherlands, is located in the Caribbean Sea. Sint Maarten achieved country status and self-governing power through reforms in 2010. Sint Maarten is *not* an independent State, instead, the Kingdom of the Netherlands is considered the “State” and it is therefore a Member State of the European Union (EU). Sint Maarten only enjoys an associated status to the European Union (EU) as an Overseas Country and Territory (OCT) under the Lisbon Treaty and is not directly subject to EU law. For the gap analysis of the relevant regulatory and technical standards of Sint Maarten and the World Bank requirements, see in the [original ESIA of 2023](#). Where a gap exists, the most stringent limits will apply to enhance clarity and alignment with good international practice.

2.1 Great Salt Pond (National Monument)

The Great Salt Pond (GSP), is located in south-central Sint Maarten and is bordered on all sides by Philipsburg and its suburbs. Part of the GSP has been designated as a national monument based on its cultural and historical significance. The designation as monument is based on the following criteria:

- Architectural significance due to the original state of the design

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- Heritage value as remnant of the slavery period and period of salt production in Sint Maarten
- Culturally significant due to the rare use of salt pans
- Landscape value as defining features in the GSP

An extract of the monuments register is included in Appendix 3. The associated map with features is indicated below (status 2008). According to the Monumenteneilandsverordening, in case a protected monument is demolished in part or whole without rebuilding, a permit should be requested and the Monuments Council is consulted by the Executive Council to establish if a permit should be granted and under which requirements. It should be noted that the Monument as indicated in the GIS system of VROMI differs from the original designation.



Figure 2.1 Great Salt Pond (National Monument – B-021) – Red sections were no longer present in 2008

2.2 Environmental & Social Legislation and Regulations

Most of the current legislation of Sint Maarten is adopted through National Ordinance from legislation of the former Netherlands Antilles and the former Island Territory of Sint Maarten. Other legislative instruments also applicable to Sint Maarten include:

- The Charter for the Kingdom of the Netherlands
- The Constitution of Sint Maarten
- Treaties and agreements with other states and with international organizations

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- National legislation, which came into effect for Sint Maarten in October 10, 2010
- Sint Maarten has autonomy in matters of internal affairs, including the environment. The governing body of Sint Maarten is comprised by a Council of Ministers, headed by a Prime Minister. The Parliament of Sint Maarten exercises control over Government's policies and plays a crucial role as co-legislator. A Governor is appointed by royal decree, represents the King on Sint Maarten and functions as Head of State of Sint Maarten. In accordance with the Constitution of Sint Maarten, the Government of Sint Maarten carries the primary responsibility for nature and environmental legislation, including implementation and enforcement.

There are National Ordinances promulgated to protect and preserve the environment from pollution and degradation in Sint Maarten. Ordinances, policies and decrees related to environmental and social protection that are relevant to this Project are presented in Appendix 2.

2.3 Permit Requirements

Permits for the proposed activities at the SWDS/IDS as described above, are:

- Hindrance Permit
- Infrastructure/Civil Works Permit
- Building Permit

2.4 Air Quality Guidelines and Standards

The air quality standards for the islands of the Netherlands Antilles set by the Working Group on Environmental Standards Netherlands Antilles - Milieunormering Nederlandse Antillen (WMNA) (Eindrapport Milieunormen Nederlandse Antillen, 11 June 2007) are the most relevant standards for air quality in Sint Maarten. The WMNA includes air quality standards for dust, Sulfur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Ozone (O₃), Methane (CH₄), Carbon Monoxide (CO), Lead (Pb), Chlorine (Cl), Volatile Organic Substances (VOS), and odor. IFC, environmental, Health and Safety Guidelines limits have been added for reference.

Table 2.1 Air quality norms (in µg/m³)

Product	Time unit	Limit values 2020	IFC limit values
Total suspended particles (TSP)	Year	75	-
	Day	150	-
PM10	Year	20	20
	Day	50	50
PM 2.5	Year	10	10
SO ₂	Year	50	-
	Day	20	20
	1-hrs	350	-
	10 minutes	500	-
NO ₂	Year	40	40
	1-hrs	200	200
O ₃	8 – hrs	100	100
	1 hr	235	-

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Product	Time unit	Limit values 2020	IFC limit values
Hydrocarbons (excluding CH ₄)	3 hrs	160	-
CO	12 hrs	10,000	-
	8 hrs	10,000	-
	1 hrs	22,900	-
	30 minutes	60,000	-
	15 minutes	100,000	-
Pb	Year	0,5	0,5
Cl	Year	10	-
	30 minutes	300	-
BaP	-	1 ng/m ³	-
Volatile Organic Substances	-	150	-
Odour	-	Max. 1 smell unit	-

For Green House Gasses (GHG) a 5 % reduction relative to 2010 is envisaged. Concentrations for TSP are only for dust generated during activities and not for emission norms of installations. Yearly average cannot be exceeded; other averages can be exceeded 3 times per year.

2.5 Waste and Landfill Management System and Regulations

Applicable legislation and regulation is included in paragraph 2.2 and Appendix 2.

2.6 Leachate Management and Surface Water Quality Standards

The Working Group for Environmental Norms at the Netherlands Antilles, in their final report (Eindrapport Milieunormen Nederlandse Antillen, 11 June 2007) suggests discharge limit values for household wastewater to surface water. No norms are provided in this final report for wastewater discharge for companies, but it does prescribe the ALARA-principle (As Low As Reasonably Achievable) and Stand-Still principle for wastewater discharges of companies. IFC, environmental, Health and Safety Guidelines limits have been added for reference.

For surface water quality the report prescribes quality norms for Industrial and other water types. In addition to the mentioned limits, a stand-still principle is in place in case the quality is better than prescribed limit values.

Table 2.2 Surface Water Quality Norms

	Dissolved oxygen (mg/l)	N-total mg N/l	P-total mg P/l	Feacal coliform x/100 ml	Oil/grease mg/l	Turbidity (m)
Industrial water	> 0.8	1.27	0.1	100	3	5
Other	> 4	0.15	0.02	200	0.5	5-25
IFC standards	-	10	2	400	10	

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These Norms are considered common law due to its consistent use by the Permits Department of VROMI

2.7 Ambient Noise Guidelines

The Working Group for Environmental Norms at the Netherlands Antilles, in their final report (Eindrapport Milieunormen Nederlandse Antillen, 11 June 2007) contains maximum noise levels according to time of day and use of the area. Daytime is classified between 07:00 and 19:00. IFC, environmental, Health and Safety Guidelines limits have been added for reference.

Table 2.3 Limit values noise in dB(A)

Area type	Maximum day time dB(A)	Maximum evening and nighttime dB(A)	IFC standards
Rural area, silent recreation, facilities for recovery	45	40	55 (day) / 45 (night)
Outside of urban areas, little traffic	50	45	
Cities and urbanized areas	55	50	
Close to main roads, in urban areas with some commercial activities	60	55	70 (day) / 70 (night)
City centre with residential and commercial functions	65	60	
Industrial areas	70	65	70 (day) / 70 (night)

The area types indicated in the Eindrapport Milieunormen Nederlandse Antillen do not fully align with the zoning as implemented by Sint Maarten for Pond Island. The activities most likely will fall in either “City Centre with Residential and Commercial functions” or “Industrial Area”.

2.8 Safe/Setback Distance for Landfill

The current landfill configuration has the advantage of most of its mass being situated above the saturated liquid level, which minimizes landfill gas generation and the underground migration of gaseous emissions. Sampling of soil vapour in the RAI did not identify significant landfill-type gases¹. Main remaining direct risk is the event of geotechnical failure. It is essential that the set-back distance does ensure a safe distance to the mixed Residential and Commercial Zone for geotechnical failures during earthquake events. Affected area will be in the range of ~ 0.35 – 0.45 x slope area resulting in an affected area of 30-40m from the toe of the landfill. With a slope area in the Southern part of the landfill of 80m, this would translate to an affected area of 28 – 36m. Therefore, minimum set-back distance has been applied being equal to the closest crest level of the SWDS (30m) to ensure a safe distance for geotechnical failures during earthquake events. As the resettlement area has been vacated, the projected set-back distance is now at least 68m.

¹ Baseline Environmental Site Assessment - salt pond island – “blue box” zone along soualiga road and adjacent to the Municipal Solid Waste (MSW) landfill and Irma Debris Site (IDS) Philipsburg, Sint Maarten - GALLAGHER BASSETT SERVICES, INC, January 13, 2020, PROJECT NO. 2019-3249

Our reference R005-1293149GMC-V05-tsz-NL



Figure 2.2 Set-Back Distance at 0.35 and 0.45 times slope length

Nuisances have not been considered in determining the setback distance due to existing nuisance levels, expected closure of the landfill, and the absence of permanent residents in the mixed-use area south of the SWDS.

2.9 World Bank Requirements: Applicable Safeguards Policies

This project has been classified as a Category A project, as documented in the Integrated Safeguards Data Sheet(ISDS). Based on early scoping of the project by World Bank environmental and social specialists, the following

World Bank safeguards policies are triggered:

The World Bank Operational Policies triggered by this project are:

- Environmental Assessment (OP/BP 4.01)
- Natural Habitats (OP/BP 4.04)
- Pest Management (OP/BP 4.09)
- Physical Cultural Resources (OP/BP 4.11)
- Involuntary Resettlement (OP/BP 4.12)

Projects on International Waterways (OP/BP 7.50) is not seen as relevant as this specific part of the project does not involve any offshore components.

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Table 2.4 Overview of policies

Safeguard Policies

Environmental Assessment OP/BP 4.01

The project is rated Category A. The activities at the municipal waste disposal site that encompass higher risks are related to: re-sloping and recontouring, as well as the fire suppression activities for subsurface fires. In terms of the social aspects, disruptions to businesses during works are expected.

Risks include dust and noise pollution, smoke during firefighting activities and re-contouring and waste slope instability. Large volumes of soil will need to be brought to the site for the final cover layer, increasing traffic along access routes.

Natural Habitats OP/BP 4.04

This policy is triggered because waste/lixiviates and rain run-off from landfill to the GSP. The construction of the new ring dike will require the removal of the current mangrove perimeter line. In addition, the large volume of soil needed for landfill closure will need to be brought from other islands, triggering the risk for importing non-native-soil biota, become invasive species.

The ESIA will assess any negative impacts, and the ESMP will provide guidance to managing associated risks related to impacts on the natural habitat. According to the Integrated Biodiversity Assessment Tool (IBAT), supported by Conservation International (CI), International Union for Conservation of Nature (IUCN) and United Nations Environment Programme (UNEP) the GSP is classified as an “*Important Bird and Biodiversity Area*” and hydrologically connected to Fresh Pond. Although these are not RAMSAR sites, (a wetlands location designated to be of international importance) they are important natural habitats, therefore OP 4.04 was triggered.

Pest Management OP/BP 4.09

This policy on pest management is triggered as the municipal disposal site management may require managing pests (e.g., flies, roaches, rodents as well as mosquitoes).

Physical Cultural Resources OP/BP 4.11

This Safeguard has been triggered as, due to a lack of space, the new ring dike will need to be installed in the GSP. Part of the GSP is designated as a national monument and Pond Island has government buildings, a college, festival village, ball fields and the residential communities, located adjacent to the SWDS and IDS. This policy addresses physical cultural resources which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance.

Involuntary Resettlement OP/BP 4.12

Involuntary resettlement was triggered because of the need to resettle those living in the community directly South of the landfill. As part of this addendum, there are two external business operators on the IDS and SWDS, i.e., Windward Roads and Steel Crushers, who will need to be relocated to achieve the necessary safe closure and recontouring of the landfill. Of these Windward Roads B.V. has an informal agreement with VROMI. Steel Crushers B.V. holds a long term lease on their plot. The Sint Maarten Soccer Association owns a plot which is currently used for landfilling on the IDS side. This plot was originally intended to build a soccer stadium but the

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Safeguard Policies

stadium was never built and, in the final situation cannot be utilized for this purpose. No additional actions in relation to businesses or residents in the vicinity of the landfill are anticipated as a set-back distance is included.

2.9.1 The World Bank Group's Environmental, Health and Safety Guidelines (EHSGs)

The World Bank Group Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). EHS Guidelines are applied as required by their respective policies and standards. The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. EHSG limit values will be adopted where more stringent than national limit values. Specific reference is made to the EHS guideline for Waste Management Facilities.

2.9.2 ESIA Process, Consultation, and Review Process

The following steps have been taken in the process:

- The draft ESIA was published on the website of the NRPB² on the 3rd of September 2025
- Public consultation on Wednesday, September 3, 2025 at the Belair Community Centre
- Questions and Answers to the Public Consultation were prepared and [disclosed on NRPB website](#) in January 2026

²

https://nrpbxm.org/event/wastefuture/?fbclid=IwY2xjawNY2_5leHRuA2FibQlxMABicmlkETF0aVZ6QjJqT0sxeWFkSjdiAR5XwdR9SGpc1WS-YZm-yfTt1Lg-RSq9LkaqeZPHpmr165gMgEJdkq6_Hqe1w_aem_wz9UeUhd3Eeyotm00JmWyg



Figure 2.3 Public stakeholder consultation at Belair Community Centre on Wednesday September 3rd, 2025 (photo courtesy of DCOMM)

3 Environmental and Social Baseline Information

3.1 Description of the Environment and Social Context

3.1.1 Economy of Sint Maarten

Sint Maarten is a constituent country of the Kingdom of the Netherlands in the Caribbean. It occupies the southern half of an island shared with the French overseas Collectivity of Saint Martin. It is the most densely populated country in the Caribbean with a population of about 43,200 and a per capita gross domestic product (GDP) of US \$25,381.

The main industry of Sint Maarten is tourism with approximately 85 % of the island workforce engaged in the tourism industry. The restaurants, hotels, and other tourism-related sectors—including the wholesale and retail trade—the real estate (including rentals) and business sectors account for approximately 45 % of Sint Maarten’s GDP. Activities in the transport, storage, and communication sectors are also related to the tourism sector and make up 11 % of the GDP. The tourism sector contributed 73 % to the country’s total foreign exchange income in 2016. Sint Maarten’s harbour is a significant port for cruise tourism in the Caribbean, while the airport is an important hub for regional travel, with a large network of connecting flights across the Caribbean. In 2024 the Department of Statistics reported 473,132 stay-over arrivals and 1,374,362, cruise passenger arrivals, which increase notably the pressure on the country’s infrastructure and services (traffic, (waste-)water, electricity health care, et cetera).

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3.1.2 Demographics of the Project Affected Area

In 2024 the resettlement of those living in the RAI was completed and hence, to ensure no residential properties remain in the primary safety zone (as described in section 1.3). Demolition of structures was completed in June 2025. The closest residences are now directly South, but further away from the active tipping in the project area (see Figure 3.1) indicated in red (location of houses) and blue (housing in sea containers). The ownership of these plots' rests with Eilandgebied Sint Maarten.

The southern half of Pond Island is comprised of residential areas, government buildings, a university, a baseball field, and various businesses. Specific businesses include but are not limited to the following: University of Sint Maarten, Sint Maarten Government Building/Census Office, Carnival Village, Brothel, Telem Group, numerous bars/restaurants, scrap yards, a pump house facility, GEBE electricity substation, Sint Maarten Festival Village Turning Point, Safe Haven, parking lots and residences.



Figure 3.1 Location of closest residential housing

An extract of Pond Island ownership (status summer 2024) is included in appendix 5.

3.1.3 Social Baseline – Affected Entities

The following external parties will be affected by the landfill works:

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- Steel Crushers B.V. – operating a facility for collection and scrapping of metals (mainly cars). Operating under a Long Lease³ of 7,935 m² for plot 192/2017 in IDS till 17 December 2028. Steel Crushers B.V. operates under Hindrance Permit HP.2021.017. There is no residence or other business in or proximate to their operation in IDS. Their assets include both movable items (shredder, containers, and stockpiles) and immovable/sunk investments (concrete slab beneath the crusher, perimeter fencing, septic system, and utility connections)⁴
- Windward Roads B.V. (WWR) has a C&D management facility within the main SWDS. They have a verbal agreement with the government for the use of the site they currently operate in SWDS (estimated about 14,000 m²), While there is no formal rental or long lease agreement for the site use, this informal agreement is well recognized by both WWR and the government. There is no resident or business in or proximate to their operation in SWDS. Their movable assets are listed in Table 3.1. WWR does not have immovable assets
- Sint Maarten Soccer Association holds a long lease of 15,000 m² for plot 190/2016 on the IDS side to build a soccer stadium. The Association acquired the lease in 2017. The stadium has never been built, as this plot has been used for landfilling since 2017 after Hurricane Irma. The Soccer Association has no asset in IDS.

Table 3.1 Assets of Windward Roads B.V. located at SWDS

Number of asset	Description
1	Water trailer
2	Storage container
3	Crusher big
4	Crusher small
5	Conveyor
6	Old sifter (used for spare parts)
7	PVC pipes, concrete, formwork, duct pipe, scaffold
8	Base course
9	Sand
10	Soil
11	Topsoil
12	Rocks
13	Sifted sand and soil
14	Loaders
15	Mobile excavators
16	Track excavators
17	Trucks

An extract of the ownership is included in Appendix 5. The mentioned affected entities are included in figure 3.2.

³ In a long lease, the Government of Sint Maarten leases government owned land to private entities for extended periods (typically 60 years) to promote economic activities. Lessees pay a nominal annual fee, and the land cannot be reclaimed without compensating for investments

⁴ Detailed valuation survey is yet to complete for Steel Crushers

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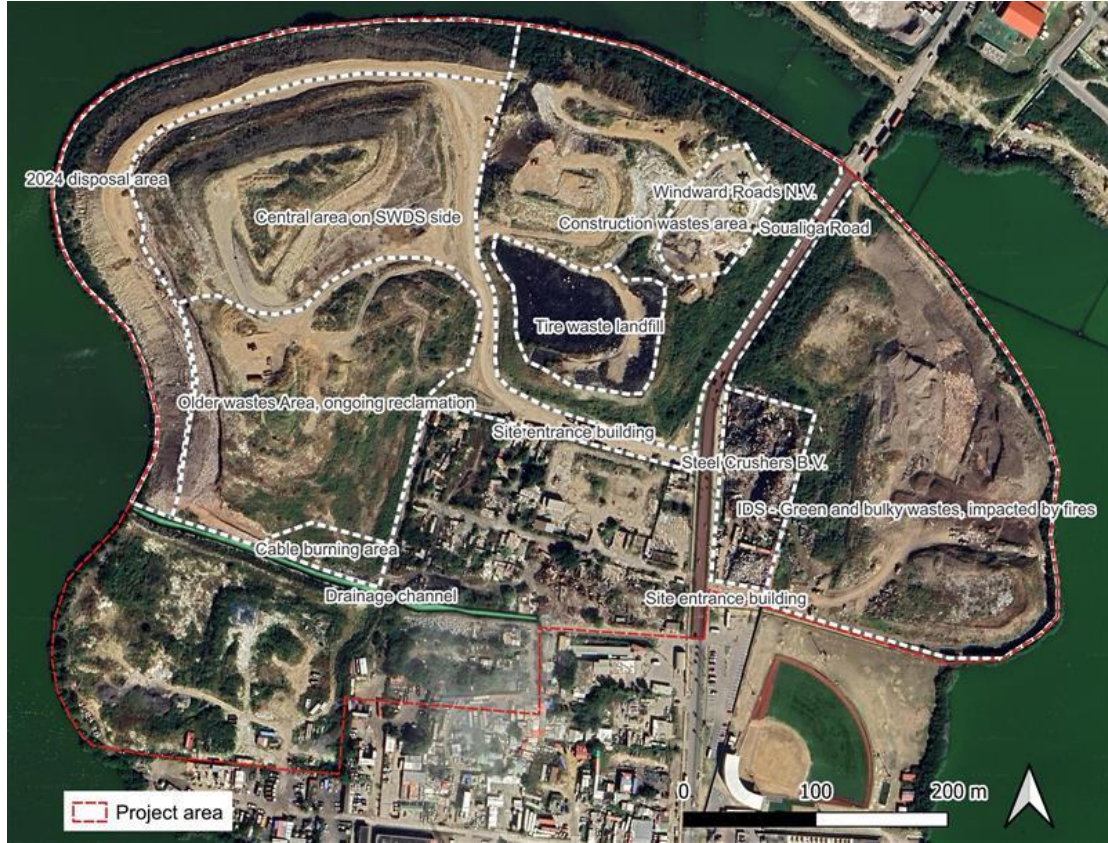


Figure 3.2 Pond Island with various entities included

For the project activities, these three entities need to vacate their premises permanently. Steel Crushers and WWR will be resettled in VROMI yard and will continue their operations as an integral part of the government's waste management strategy (Waste Vision 2050). For the Soccer Association, the Government will provide replacement land.

Based on the anticipated updated activities, especially concerning the slope recontouring and reprofiling activities where large volumes of soil need to be moved, and also the traffic impact related to material transportation, a red and yellow zone has been established accordingly. These are presented in Figure 3.3 and Figure 3.4.

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Figure 3.3 Red and yellow zones based on activities



Figure 3.4 Red and yellow zone on Pond Island

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The GSP was historically used for salt production, which continued till the 1940s. The creation of Pond Island since the 1970s has greatly reduced the size and visual appearance of the GSP. On the SWDS side, Salt Pan structures are only visible during very low water levels. East of the IDS side, there are salt pans under the List of Monuments of Sint Maarten, see Figure 2.1 for their location.

3.1.3.1 Community Social Baseline of the New Yellow Zone/ Impact Zone by the Landfill Work

The southern half of Pond Island is comprised of mixed commercial/residential areas, government buildings, a university, a baseball field, and various businesses. Specific businesses include but are not limited to the following: University of St. Martin, Sint Maarten Government Building/Census Office, Carnival Village, Telem Group, Post office, numerous bars/restaurants, brothel, vehicle inspection building, scrap yards, a pump house facility, GEBE electricity substation, Sint Maarten Festival Village, Turning Point, Safe Haven, parking lots and residences.



Figure 3.5 Map with the Extent of the Different Alternatives and Receptors

An increase in traffic, including heavy lorries is expected along Juancho Yrausquin Blvd, Walter A. Nisbeth Road between Juancho Yrausquin Blvd and the roundabout with Soualiga Road and the western side roads of Soualiga Road (unnamed) on Pond Island. The routes pass mostly over the main road, past mixed commercial and residential areas. The following specific sensitive receptors are present along the roads.

- Sundial middle school at the corner of Juancho Yrausquin Blvd and Walter A. Nisbeth Road. The school is open from Monday to Friday 07:30 till 15:00

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- University of St Martin along Soualiga Road. The University operates from Monday to Friday 08:00 till 18:00

In addition to the mentioned educational facilities, various government and sports facilities are present along the route.

3.2 Physical Environmental Data of Sint Maarten

3.3 Climate and Meteorology

The island of Sint Maarten exhibits a marine climate, classified as "Am" according to the Köppen classification scheme. This climate is characterized by distinct dry and rainy seasons, with the dry season occurring from January to April and the rainy season from August to December. The prevailing winds in the region are from the east to northeast, with moderate to fresh intensity.

Showers can be a common occurrence during the late afternoon, particularly during the summer months when they are limited and of light intensity. However, as autumn approaches, showers become more frequent and can be moderate to heavy, often accompanied by thunderstorms. The average temperature on the island remains tropical, hovering around 27 °C throughout the year, with August being the warmest month.

The seawater surrounding the island maintains an average temperature of approximately 27.2 °C. Skies are generally clear to partly cloudy, providing ample sunshine. Wind speeds at an elevation of 10 m above ground level consistently average around 9 m/s, with a prevailing direction from the east to northeast.

According to climatic records, the hurricane season on Sint Maarten spans from June 1st to November 30th, with the peak season occurring from August through October. Being situated within the Atlantic hurricane region, the island has experienced the passage of 64 hurricanes within 120 nautical miles on either side of its location, based on data spanning from 1851 to 2009.

For the project climate data from Princess Juliana Airport was requested for the period January 2019 – December 2023. During this period no major hurricanes were registered in the climate data.

Table 3.2 Climate data based on weather station at Prinses Juliana Airport for January 2019 till December 2023

	Average precipitation (mm/month)	Daily maximum precipitation (mm)	Average Max T (Celsius)	Average Min T (Celsius)
January	65.30	21.30	29.23	23.61
February	51.86	16.70	29.10	23.42
March	36.12	16.90	29.38	23.85
April	26.72	11.00	30.08	24.56
May	39.78	30.30	30.97	25.81
June	48.48	24.00	31.63	26.55
July	90.36	71.80	31.90	26.78
August	112.34	84.20	32.30	27.04

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	Average precipitation (mm/month)	Daily maximum precipitation (mm)	Average Max T (Celsius)	Average Min T (Celsius)
September	93.96	44.50	32.50	27.08
October	178.16	105.80	31.83	26.32
November	100.62	76.60	30.88	25.48
December	68.52	30.10	30.15	24.49
Total	912.22	105.80	30.83	25.41

3.4 Ambient Air Quality

Site reconnaissance of the SWDS and IDS Site, and surrounding neighbourhoods, conducted by EE&G in 2017, 2018, and 2019, revealed that dust control practices were minimal. Dust was most visible at work/landfilling locations and on vehicular roadways. Excavation of burned wastes particularly generated dust (Environmental Field survey Report, R002-1293149ABR-V03-mvg-NL, Witteveen+Bos and TAUW, November 28th 2024).

Ambient air quality data for the Island of Sint Maarten was not readily available. A preliminary screening of the smoke and fumes originating from the subsurface fires was conducted by the contracting company EE&G and Dutch National Institute for Public Health and the Environment (RIVM) in August 2018. These assessments are presented in the following paragraphs.

3.4.1 Air Quality at the SWDS/IDS

The information in this section of the original ESIA is still accurate, for further reference see the corresponding section in the document Environmental and Social Impact Assessment – ESIA (Jan 2023).

EE&G performed a preliminary air quality screening of smoke and fumes from subsurface fires at the SWDS/IDS in January 2020. Identification of Contaminants of Concern (COC) were found to exceed occupational exposure levels (OELs) within smoke fumes emanating from fissures on the SWDS at a height of 1,5 meters above the fissure, and particulate levels, exceeding OELs, were found in the cabs of equipment and upwind of smoke fumes. The results and conclusions that were presented did not contain reference to or discussion of potential for offsite migration of COCs, or the potential for impacting surrounding populations.

The thermographic information available showed the status of the IDS and SWDS in August 2018 and 2019 which is likely not representative of the current state of the area. As landfill fires have been largely controlled since, this information is no longer relevant.

3.4.2 Air and Odour Monitoring Study of Areas Surrounding MSW

The Environmental Incident Service (MOD) of the Dutch National Institute for Public Health and the Environment (RIVM) measured the air quality around the SWDS/IDS at Philipsburg, Sint Maarten for two weeks⁵. The measurements were collected between January 24 and February 6, 2019. The study identified local air flow in the area, as indicated in Figure 3.6.

⁵ Investigation of the air quality around the landfill Sint Maarten 2019 (RIVM report 2019-0056)

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Figure 3.6 Local airflow (source RIVM)

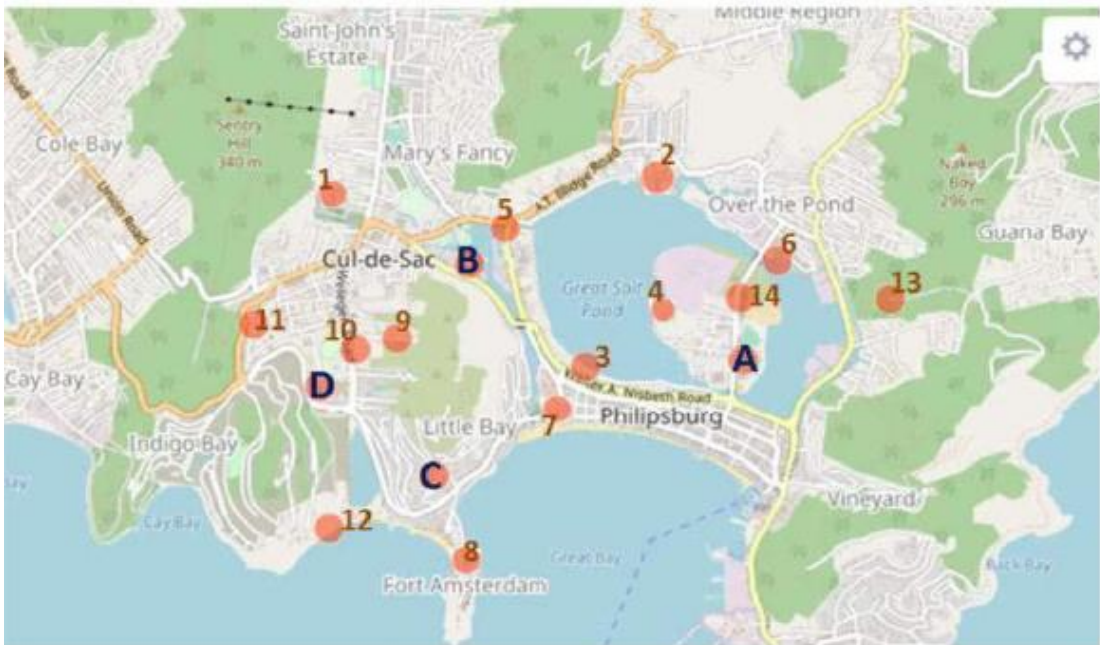


Figure 3.7 Sampling points (source RIVM)

Figure 3.7 shows the map of all sampling location: Sample locations (A-D) are fixed monitoring locations with 24/7 sampling equipment and Sample locations (1-14) are historical and instantaneous locations using other techniques. The following measurements were taken:

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particulate matter (PM10), inorganic gases, Volatile Organic Components (VOC), aldehydes, Polycyclic Aromatic Hydrocarbons (PAHs), dioxins and Polychlorinated Biphenyls (PCB).

Concentrations of aluminium and possibly chromium measured were found to exceed the standards that apply for life long exposure, however, expected potential health effects were seen as negligible. For PAHs some samples exceeded the limit values for life long exposure. Odour nuisance was detected but not quantified.

Concentrations of PM10, as a good indicator for activities and dust formation on the landfill, were below the average exposure limit of 40 µg/m³, with the exception of location 4 (directly downwind of the SWDS) where the exposure limit of 50 µg/m³ was exceeded on two occasions, including once for daily average.

During the measurement period there were no open fires at the SWDS/IDS. As a result, the RIVM was unable to assess the potential health risks of substances released in the event of an open fire at the SWDS/IDS.

3.4.3 Landfill Gas Estimates

The methane generation at the MSWDS at Philipsburg Sint Maarten was calculated by using the IPCC model (first-order decay). Based on the calculations the current (2024) yearly methane generated in the landfill is around 1,453 tonnes of CH₄ and the peak of CH₄ generation will be reached in 2027 with 1,593 tonnes of CH₄. For more information, please refer to Methane gas model calculations for the MSWDS, Philipsburg, Sint Maarten, TAUW note N002-1293149ABR-V01-rlk-NL, d.d. January 15th 2025.

The Baseline Environmental Site Assessment at Salt Pond Island – “Blue Box” Zone along Soualiga Road and adjacent to the Municipal Solid Waste (MSW) Landfill and Irma Debris Site (IDS) Philipsburg, Sint Maarten (Gallagher Basset Technical Services (GBTS), January 13th, 2020) did not identify significant landfill gas or VOCs concentrations in the vapour wells placed inside the RAI and concentrations of carbon monoxide and an incidental Lower Explosion Limit increase did not warrant further assessment or monitoring.

3.5 Existing Traffic Patterns

Soualiga Road serves as the only access road for the SWDS/IDS. It runs in a north south direction across Pond Island separating the SWDS and IDS. Entrances to the SWDS from Soualiga Road are through a small narrow dirt road (Brine Drive) and an unnamed dirt road, respectively. There are no alternative roads that could be used during an emergency should Soualiga Road become unusable. Typically, the traffic laws/controls focus on adherence to the Traffic Ordinance. The traffic law restricts truck delivery of supplies from 6:30 AM to 8:30 AM and from 12:00 PM to 2:30 PM. The restriction applies for Soualiga Road every day except Sunday. However, the traffic counts indicate a presence of (waste) trucks during these hours, with the highest numbers of trucks between 07:00 and 10:00. A traffic assessment was executed on Soualiga road at the Southern end of the exit of Brine Drive. The Traffic assessment was done over a period of 2 days:

- 7.00 AM till 12:00 PM on Thursday August 15th 2024

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- 12:00 PM till 5 PM on Friday August 16th 2024

In total 2895 vehicles passed the control point in the direction of Philipsburg and 2164 vehicles passed the control point travelling from Philipsburg. Main traffic was in the morning and late afternoon hours, likely associated with commuter work to the government offices on Pond Island.

Table 3.3 Cummulative Traffic assessment on Soualiga road

From	To	Cars, pick-up trucks, motorbikes	Regular trucks	Waste trucks	Other vehicles
07:00	08:00	570	5	22	1
08:00	09:00	545	15	15	0
09:00	10:00	443	4	25	1
10:00	11:00	399	10	13	0
11:00	12:00	356	3	17	0
12:00	13:00	449	3	8	3
13:00	14:00	561	7	3	1
14:00	15:00	485	7	3	0
15:00	16:00	472	2	6	0
16:00	17:00	595	5	5	0
	Subtotal	4,875	61	117	6

3.6 Ambient Noise

No ambient noise studies were available. The noise on Pond Island is affected by a wide variety of activities. The existing facilities on the MSWDS will generate noise. As part of other NRPB procurement, rock crushers have been requested. Maximum noise levels were up to 90 dB(A) at 10 m distance with other equipment at lower noise levels of 71 and 70 dB(A) at 10 m distance A metal recycling facility or scrap yard can result in a maximum noise pressure up to 90 dB, with an average noise level in the order of 80 dB.

3.7 Geology

The bedrocks of Sint Maarten consist primarily of andesite tuff and tuff breccia from Eocene volcanic events. These have been intruded by basalt, quartz diorite, and andesite. Later volcanic activity caused intrusions which have metamorphosed the rock and caused the tuff to tilt and fold. Limestone and marl were deposited on the eroded surfaces of these materials.

At the end of the Pleistocene glaciation, ice melted and the sea level rose. The large, single island flooded and only the highest parts remained above sea level – forming the islands of St. Martin/Sint Maarten, Anguilla and St. Barthélemy as they are known today. The tuffs form the Pointe Blanche formation, which is most visible at the southern end of the island. There are limestone caverns on Sint Maarten/St. Martin where the softer limestone was exposed. The Simpson Bay Lagoon, Great Salt Pond (GSP), Great Bay and other bays and lagoons are drowned valleys. The plateau the neighbouring islands sit on has a maximum depth of 36m and is known as the Anguilla Bank.

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3.8 Topography

The Island is hilly with scattered valleys. Some of the hills are sparsely wooded with a few areas of heavy vegetation. The highest point on the Island, located on the French side, is Pic Paradis at 1,391 ft (424 m); the highest peak on Dutch Sint Maarten is Mount Flagstaff at 383m, the lowest point is at sea level. The area to west of the Island around the airport is flatter and contains the Dutch section of the Simpson Bay Lagoon. The GSP lies to the north of Philipsburg. Several small islands lie off the coast, notably Cow and Calf, Hen and Chicks, Molly Beday, Pelican Key, and Guana Key. The Keys located in the Simpson Bay lagoon are Great Key and Little Key.

3.9 Pond Island

Pond Island is, with the exception of the SWDS and IDS, a relatively flat island which was constructed in phases by infilling of the GSP expanding from the main Soualiga Road. There is no further information known on the quality of soil or groundwater on Pond Island except for the information gathered as part of the current project. The land-use on Pond Island is a mixture of commercial with limited residential. In addition Pond Island houses the main government offices, University of Sint Maarten and recreational facilities.

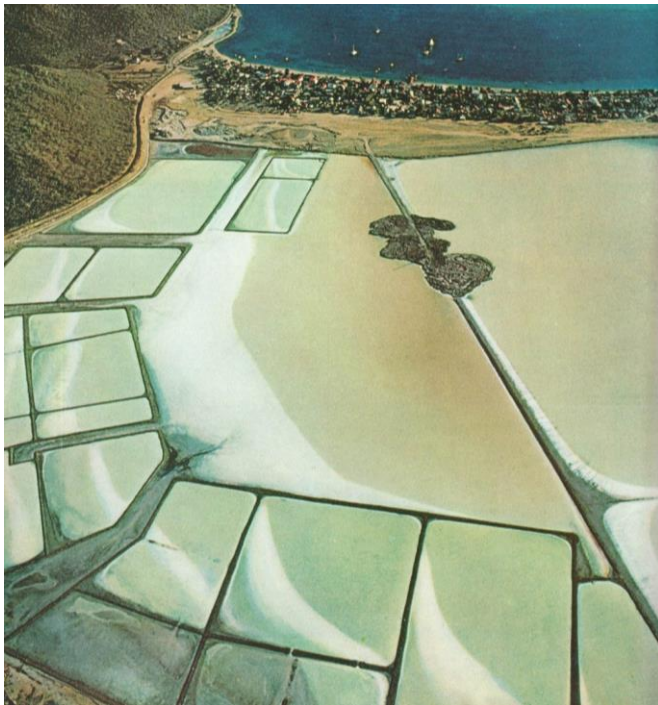


Figure 3.8 Great Salt Pond in 1970 with main road (Source Emory Kristof for National Geographic - [Salt Pans – St. Martin Image Collection \(amuseumnaturalis.com\)](#))

3.10 Soils

Pond Island was created utilizing rock and soil excavated from Fort William Hill as fill. There are no available construction plans, details, or cross sections from the construction of the SWDS/IDS. Based on the gathered soil data during site investigation, is assumed that a system of walled sections, using locally available large boulders, and very similar to the set-up used for the

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construction of the salt pans were filled with beach sand before landfilling / reconstruction in the area commenced.

The Baseline Environmental Site Assessment at Salt Pond Island – “Blue Box” Zone along Soualiga Road and adjacent to the Municipal Solid Waste (MSW) Landfill and Irma Debris Site (IDS) Philipsburg, Sint Maarten (Gallagher Basset Technical Services (GBTS), January 13th, 2020) was a comprehensive assessment of the state of the soil and presence of soil gas in the RAI area. The report concluded that, although elevated, concentrations of arsenic, copper, lead, PAHs, TPHs, and dioxins/furans detected in the surficial soils did not represent a major exposure concern for the existing residential and commercial uses ongoing in the RAI area.

3.11 Surface water at Great Salt Pond

The topography around the GSP is hilly, with the pond acting as a catchment basin for storm water. Land use surrounding the GSP is a mix of residential and commercial.

The topography immediately surrounding the SWDS/IDS is relatively flat. The topography beyond the GSP is mountainous and therefore storm water management is necessary and the GSP is a critical retention basin in that regard.

Storm water flows from the SWDS/IDS landfills directly to the GSP or to drainage ditches that ultimately drain into the pond. There is a drainage trench along the southern part of the SWDS which drains into the GSP. A second drainage channel is present between the IDS and Baseball field, this channel also drains directly to the GSP.

The GSP also receives stormwater runoff from surrounding neighbourhoods and roadways as well as drainage and stormwater from the Fresh Pond which drains into the GSP. Water from the GSP is periodically pumped into the Great Bay via the Rolandus Canal, which is located to the east of the GSP that drains into the Great Bay to the south of Philipsburg. Great Bay has an active beach/recreational use area.

A bathymetric assessment of the GSP was completed by the University of South Florida Water Institute in October 2019, which is summarized below:

- Perimeter – 8,555 meters
- Area – 282.9 Acres (114.5 hectares – excluding Pond Island)
- Mean depth – 0.77 meters
- Volume – 712.8 Acre-ft (232,267,344 gallons)
- Deepest point – 1.48 meters

A copy of the bathymetric assessment is presented below in Figure 3.9.

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Figure 3.9 Bathymetric Readings for the Great Salt Pond (University of South Florida Water Institute)

The same institute also performed an inflow/outflow assessment of the GSP in October 2019. The assessment was performed to identify locations where water appeared to enter or leave the GSP. Features were identified as the following:

- Green Box: Outfall to/from the GSP – main outfall is the control structure on the northwest edge of the GSP
- Green Circles: Culverts – observed as either a pipe, headwall, or hardened infrastructure
- Black Hexagons: Ditch outfalls were observed as open earthen or concrete linear constructed depressions
- Red Triangles: Pump house/station
- Purple Pentagons: Swales were observed as runoff flow channels typically exchanging water with the surrounding ditch on the western edge

GSP accepts stormwater runoff from the SWDS/IDS landfills as well as the surrounding areas, numerous inflow/outflow points were identified where water can intermingle with adjacent bodies of water. A copy of the inflow/outflow assessment of the GSP is presented below in Figure 3.10.

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Figure 3.10 Great Salt Pond Inflow/Outflow status 2019

Surface water sampling of the GSP was performed in October 2019 (Gallagher Basset Technical Services (GBTS), January 13th, 2020). The purpose of the surface water assessment was to establish baseline conditions in the GSP prior to the initiation of activities aimed at suppressing the sub-surface fires at the SWDS and Irma Debris Site.

To establish baseline water quality conditions within the GSP prior to the initiation of fire suppression activities, a total of 18 samples were collected from 8 discrete locations (13 samples from the surface and 5 'deeper' samples collected from the bottom 0.45 meters of the pond's water column). At each sampling location, measurements of field parameters and representative water samples were collected from both the surface and the bottom of the water column. See the figure below for a map depicting the sampling locations.

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Figure 3.11 Surface water sampling locations

Table 3.4 Surface water field measurements of the Great Salt Pond (October 2019)

Surface water sample	Sample depth (m below surface)	pH -	EC ($\mu\text{S/cm}$)	Temperature ($^{\circ}\text{C}$)
GSP-1	0.1	8.16	9,692	31.60
GSP-1	1.0	8.28	9,743	30.98
GSP-2	0.1	8.59	9,435	32.39
GSP-2	1.0	8.57	9,608	31.07
GSP-3	0.1	8.21	9,406	29.77
GSP-4	0.1	8.46	14,138	31.30
GSP-4	0.7	8.58	14,346	30.52
GSP-5	0.1	8.53	9,739	32.38
GSP-5	1.04	8.72	9,951	32.03
GSP-6	0.1	9.24	9,008	33.50
GSP-6	1.09	9.34	9,025	33.39
GSP-7	0.1	8.74	9,153	30.98
GSP-8	0.1	8.56	14,021	31.06

None of the analysed samples were found to contain elevated values in excess of the compounds listed in the EU's Maximum Allowable Concentrations (MACs) established in the Directive 2008/10/EC Annex 1, except for PAH compounds anthracene, fluoranthene and benzo(a)pyrene. A review of the field readings showed that there are typically low dissolved oxygen levels at just

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1 m below surface. Given the levels of COD noted in the analytical results and the high turbidity at depths, the general water quality appears to be poor and likely the main influence in the fish kills observed during the site reconnaissance.

The surface water samples also revealed high levels of total coliform bacteria and *E. coli* at levels too numerous/elevated for the laboratory to quantify. This suggests that sewage is being discharged into the GSP.

On August 10, 2024, surface water measurements were conducted. The sampling was performed at seven different locations, which included areas of surface water runoff, the leachate channel, and regions surrounding the VROMI yard and east of the IDS.



Figure 3.12 Surface water sample locations

The surface water at a total number of 7 locations was tested. At point 41 surface water runoff was measured during a heavy rainfall event. At point 42 the quality was measured at the leachate channel. Surface water points 43 and 44 were measured southwest of the VROMI yard and surface water points 45, 46 and 47 were measured east of the IDS.

Table 3.5 shows the field measurements obtained during surface water testing. As expected, the electrical conductivity (EC) is lower at points 41 (surface water runoff) and 42 (leachate channel). East of the IDS the measured EC at point 46 is low, possibly caused by sub-surface outflow of

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leachate. To a lesser extent a lowered EC is also present at measurement 45, southeast of the IDS. The increase in surface water temperature observed from sample 41-1 to 47-1 is likely due the time of day when the measurements took place.

Table 3.5 Surface water field measurements of the Great Salt Pond

Surface water sample	pH	EC ($\mu\text{S/cm}$)	Temperature ($^{\circ}\text{C}$)
41-1	8,88	670	27.7
42-1	7.83	5,790	28.6
43-1	8.12	19,800	29.6
44-1	8.15	20,000*	29.9
45-1	8.08	9,500	30.0
46-1	8.20	1,600	30.9
47-1	8.16	15,780	31.5

* Maximum range = 20,000

Due to steep slopes the shore at the north and western part of the SWDS were no longer accessible.

Further baseline surface water sampling was executed by CARIRI (Assessment of Seawater Quality Testing of Six (6) Areas to Establish a Baseline, SX-NRPB-367264-CS-CQS, September 25th 2025). On the 2nd and 3rd of May 2025, and 26th till 27th of May 2025, CARIRI took 5 grab samples (GSP-G1-BW to GSP-G5-BW) and 2 composite samples (Composite sample 1 – GSP #1 - # 10 East and GSP #1 to #10 West). Sediment samples were taken on the 12th and 13th of May (one composite from 10 locations, exact locations unknown).

Individual samples were tested for Bacteria in water (microbial counts for Faecal Coliforms, E.coli and Enterococcus), composite samples were tested for Nutrients and pollutants (eC, Total Nitrogen, Total Suspended Solids, Total Phosphorous, Chemical Oxygen Demand, Biological Oxygen Demand, Oil and Grease). Sediment samples were tested for heavy metals (Cd, Cu, Ni, Pb, Zn, Hg, Cr).

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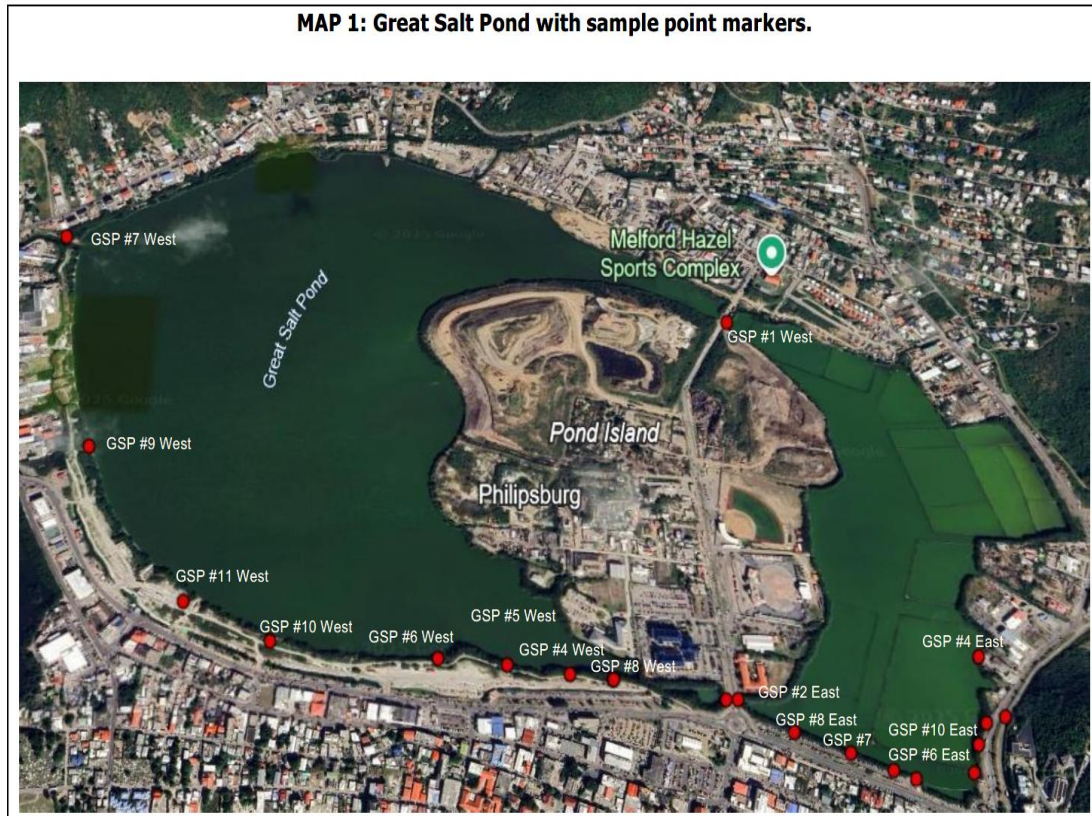


Figure 3.13 Sampling Points CARIRI investigation 2025

	Electrical Conductivity (uScm-1)	Total Nitrogen (mg/l)	Total Suspended Solids (mg/l)	Total Phosphorous (mg/l)	Chemical Oxygen Demand (mg/l)	Biological Oxygen Demand (mg/l)	Oil & Grease (mg/l)
Event 1B: GSP-C1-NP	19,120	19.45	34	2.96	828.5	201.1	1.43
Event 1B: GSP-C2-NP	14,017	21.18	52.67	2.65	487.5	63.3	1.07
Event 3: GSP-C1-NP	9,440	22.8	134.29	1.92	740	17.4	4
Event 3: GSP-C2-NP	9,239	20.8	101.43	1.7	407.5	19.5	4
Average levels:	12,954	21.06	80.60	2.31	615.88	75.33	2.63
Acceptable levels:	<400	≤1.5	≤25-30	<0.1	≤50	≤3-5	<10

Figure 3.14 Results from physicochemical parameters at Great salt Pond, sampling dates event 1B (02/03 May 2025) and event 3 (26/27 May 2025)

All microbial counts consistently and significantly exceeded the acceptable limits for Faecal Coliforms (<400 CFU/100ml), E.coli (<126 CFU/100ml) and Enterococcus (<33 CFU/100ml). For Nutrients and Pollutants all parameters exceeded the acceptable limits, with the exception of Total Suspended Solids and Oil & Grease.

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Table 3.6 Sediment quality test results (mg/kg)

	Great Salt Pond GSP-C1-HM
Cadmium	0.86
Copper	26.10
Nickel	2.34
Lead	6.99
Zinc	66.15
Mercury	0.018
Chromium	4.59

Baseline conditions within the GSP suggest that the water quality may have a negative impact on flora and fauna within the pond and poses a potential health risk for human recreational and/or consumptive use. No or limited information is available on the sediment thickness.

3.12 Groundwater

Groundwater and leachate measurements were conducted on August 16, 2024 and the results are presented in the Environmental Field survey Report (R002-1293149ABR-V02-mvg-NL, November 2024).

In the study, various monitoring wells were tested, and it was observed that the groundwater levels varied, with some wells showing no presence of leachate or groundwater. pH levels mostly ranged between 5.86 and 7.54, generally staying within the normal range (6.5-8.5), except for some deviations.

EC values were elevated across all samples, with values reaching up to 20,000 $\mu\text{S}/\text{cm}$. This is significantly higher than the normal threshold of 2,500 $\mu\text{S}/\text{cm}$. Turbidity levels were also elevated, exceeding the normal limit of 10 NTU, likely due to floating particles in the groundwater, which can lead to overestimated analytical results for immobile parameters. Most groundwater samples showed temperatures above the normal threshold of 30°C, with some reaching as high as 43.1°C. These elevated temperatures, especially in wells 1, 5, and 24, suggest a significant influence of leachate from the landfill and biological activity inside the waste body.

The elevated EC is attributed to the groundwater's connection with the GSP, which contains brackish water. Interestingly, when leachate presence was higher, EC values were lower as this shows presence of freshwater inflow. Unlike other parameters, pH did not conclusively indicate the presence of leachate, as it remained relatively consistent across samples.

The study reveals significant contamination of groundwater by leachate from the landfill, as indicated by elevated electrical conductivity, turbidity, and temperature readings as well as laboratory analysis. Samples tested against the target values for wastewater treatment plants BOD and COD are elevated in all of the monitoring wells. Nitrogen is elevated in monitoring wells 3, 24 and 30. Phosphorus is elevated in monitoring well 30. Total Coliform and E. Coli were measured highly elevated in all of the monitoring wells.

A summary of the results tested against the Dutch legal framework for groundwater is presented in Table 3.7. As no specific testing framework for soil, surface water and groundwater quality exists

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in Sint Maarten, the results have been tested against the Dutch legal framework. This is one of the most widely recognized standards for soil and groundwater quality. The Dutch framework utilizes a Trigger Value (Signaleringsparameter) to assess the contamination level and need for action for contamination in groundwater. The groundwater/leachate at wells 1, 3, 24, 29 and 30 was moderately to strongly contaminated with heavy metals. The highest concentrations were found at wells 1 and 30. Monitoring well 1 is located in the center of the SWDS. Monitoring well 30 is located close to the end of the leachate channel. In wells 3, 24, 29 and 30 the groundwater contained elevated concentrations of Aromatic Hydrocarbons and PAHs, but not exceeding the limits for significant contamination.

Table 3.7 Summary of leachate and groundwater samples tested against the Dutch legal framework for groundwater

Monitoring well	Screen depth (m bgl)	> 0,5*SIG	> SIG
1*	6.65-8.85	Ba, Ni	As, Cr, Pb, Zn
3	4.50-6.50	-	Ba
4	2.80-4.80	Ba	-
5*	5.85-7.85	-	-
24	2.00-3.00	Ba, Ni	Cr
29	2.60-3.60	Ba	Cd
30	2.80-3.80	Ni	As, Ba, Cr

SIG = Signaleringsparameter (Dutch) / Trigger value (English)

* Only analysed for heavy metals

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Figure 3.15 Location of monitoring wells, well 6 did not contain any water

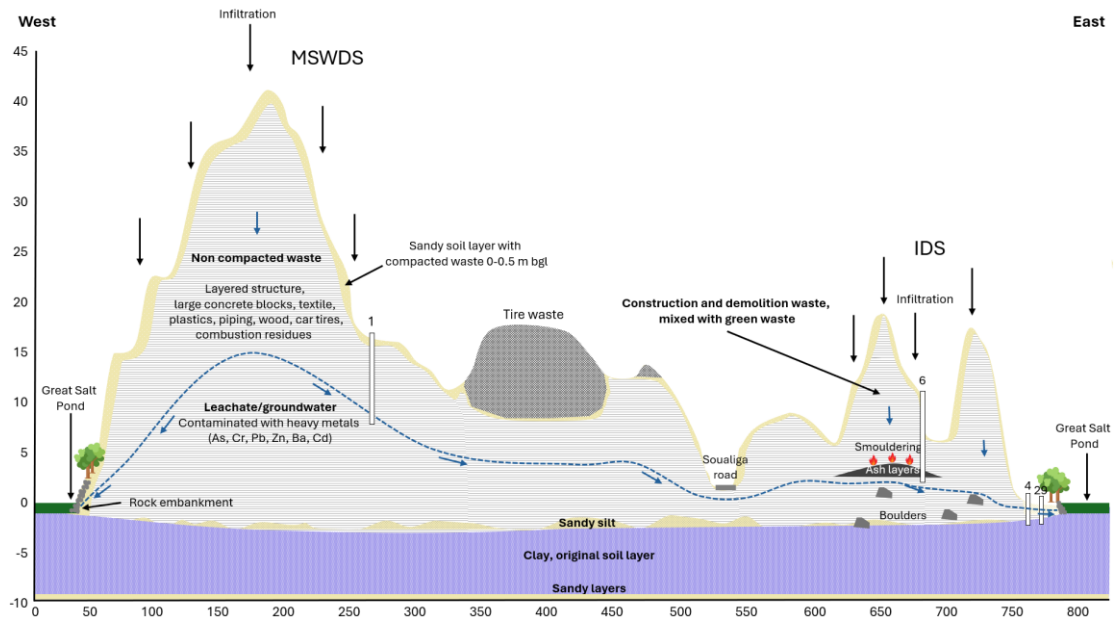


Figure 3.16 Cross section West – East of the SWDS and IDS landfill

Leachate generation and interchange with surrounding Great Salt Pond

Due to the presence of highly permeable beach sands below the landfill, it is expected that there is a strong interchange between the leachate/groundwater and the GSP. Thick clay layers at greater

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depth will limit vertical migration of the contaminated leachate. As such leachate outflow is expected to occur around the entire landfill. Preferential pathways can be present but have not been specifically detected. The specific run-off zones identified in the original ESIA were not detected during the August 2024 investigation.

South of the SWDS, there is a drainage channel is present. The channel is contaminated with wastes and has a thin layer of sludge at the bottom. Most of the channel is however filled with beach sand. During periods of high-water levels of the GSP the water colour is green, indicating strong inflow of water from the Pond itself. During periods of low water levels of the GSP, the water turns black, indicating outflow of leachate from the landfill. It is expected that this process takes place all around the landfill, but is less visible in the main parts of the GSP due to dilution.

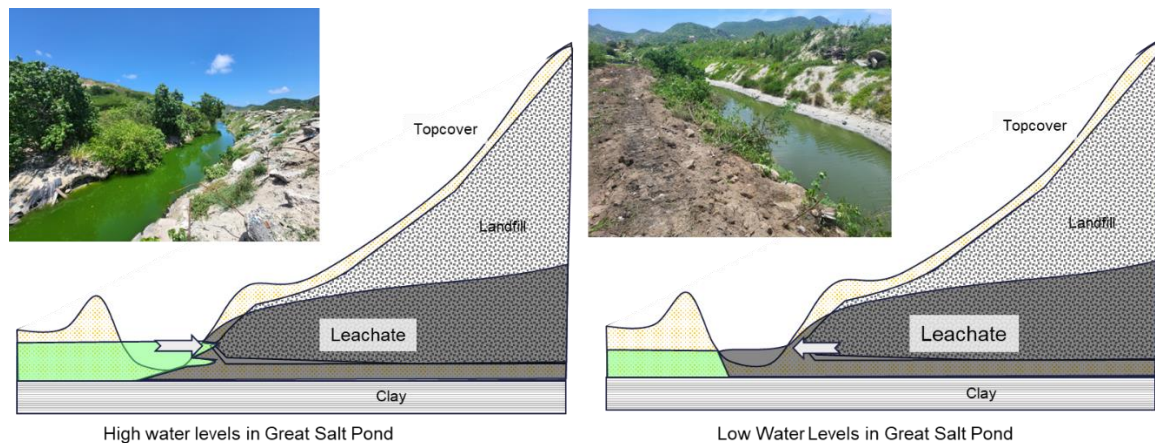


Figure 3.17 Leachate interaction with main channel

The actual volume of leachate is estimated between 91,000 – 133,000 m³/year. The leachate ranges between 50 % and 74 % of the total incoming precipitation.

3.13 Biological Environmental Data

The GSP serves as a natural water catchment basin for much of the runoff water from the surrounding hills. Mangroves can be found around all of Sint Maarten's salt ponds and in particular the GSP, which provides the necessary habitat for roosting, nesting and migrating birds. Despite the development of the surrounding area and subsequent stress to the ecosystem, the GSP provides important foraging areas for many birds and the brackish and sometimes hypersaline conditions could give rise to a unique wildlife community of several fish species, turtles, snails and insects. No Endangered, Critically Endangered or protected species, that can be impacted by the project, have been identified in the area

There is periodic mechanically induced water exchange between the GSP and the marine environment accessed through Great Bay. There is also constant exchange between each habitat for feeding and reproduction and continuous movement of water and animals between the deep waters surrounding Sint Maarten, the coral reefs, seagrass and mangrove areas. As the waters around Sint Maarten are relatively shallow, without much exchange between coastal and deep-

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water currents, corals and other organisms on reefs are exposed to any terrestrial influences including: freshwater runoff, sedimentation, nutrients, et cetera.

3.13.1 Terrestrial Flora

The 'littoral zone' refers to the coastal area of an ocean or sea, lagoon or salt pond where the transition from land to water offers a unique habitat for different vegetation types to exist. Along the shore of the GSP vegetation types are found, which have evolved due to a combination of varying environmental conditions i.e., low energy environments, saline water, and sandy soils. This type of vegetation is called Salina/ Saliña Mangrove Vegetation.

Salina vegetation includes plant species that are tolerant of saline waters and sandy soils, and evolve on the banks of the GSP where a low-energy wave environment prevails. The brackish or sometimes hypersaline nature of the GSP is a result of its proximity to the sea, lack of rainfall, and high rates of evaporation. However, the salinity can fluctuate considerably; after heavy rains in the wet season for instance, the water will be more brackish than saline because of the diluting effect of the rainwater. These variable salinity conditions mean that only well adapted plants and animals can live in and around the ponds. A marked increase or decrease in salinity or oxygen parameters may result in not only water quality issues but also may result in fish die-off events, which has previously occurred within the GSP. Species diversity surrounding the SWDS/IDS and the GSP is low and typically only one species will form the canopy. The communities consist mainly of Sea Grape (*Coccoloba uvifera*), Button Wood (*Conocarpus erecta*), Flambeau or Blactorch (*Erithalis fruticosa*) and the Portia Tree (*Thespesia populnea*)

3.13.1.1 Mangroves

Mangroves are a different species of plants and shrubs that are highly tolerant of saline and muddy waters. Mangroves are found only in depositional environments where fine sediments, often with high organic content, collect in areas protected from high energy wave action. These areas are flooded daily by rising tides allowing the formation of large plant assemblages along inland water ways and sheltered coasts, collectively known as mangrove swamps or forests.

Around the GSP four species of mangroves can be found: *Rhizophora mangle* (Red Mangrove), *Avicennia germinans* (Black Mangrove), *Laguncularia racemosa* (White Mangrove) and *Conocarpus erectus* (Buttonwood). The total shoreline length of the Great Salt Pond, most of which is covered with Mangroves is approximately 8,5 km. Figure 3.18 for mangrove thicket locations around Pond Island. Landfill operations since 2024 have focused on the old maintenance road, influencing the mangroves at the water's edge. The area of the project where mangroves will be removed and re-instated is 922m on the SWDS and 338m on the IDS. Mangroves are mostly only one line of trees thick, with slightly thicker sections on the northern shore of the SWDS and IDS.



Figure 3.18 Mangrove vegetation along Pond Island

3.13.2 Terrestrial Fauna

Sint Maarten, specifically the GSP, is classified as an important breeding and nesting area for nesting birds, migratory birds, and seabirds. One hundred and seventy species of birds can be found in or around the GSP, of which 47 are resident and nesting birds, and 123 are migrants and non-nesting visitors⁶. There are no endemic bird species on Sint Maarten since birds can move easily between the islands, and there is a lack of habitat on Sint Maarten, particularly undisturbed forest. The green iguana (*Iguana iguana*) is omnipresent around the SWDS and IDS. This species is listed in CITES Appendix II, although in Sint Maarten it is one of the most predominant invasive fauna, only arriving after 1990. The same applies to the Red-eared Slider (*Trachemys scripta elegans*). The following descriptions include common birds and birds of conservation interest specifically related to the GSP.

3.13.3 Nesting Terrestrial Birds

The Green-throated Carib (*Eulampis holosericeus*), the Antillean Crested Hummingbird (*Orthorhyncus cristatus*), Lesser Antillean Bullfinch (*Loxigilla noctis ridgewayi*) and Bananaquit (*Coereba flaveola*) thrive in secondary habitats, and occasionally live close to residential areas. It is not uncommon to see these birds in backyards in sections adjacent to the SWDS/IDS in areas slated for relocation. Yellow Warblers (*Dendroica petechia*) are a common species found in dry bushland and mangrove woodlands. Several water birds breed on the GSP, including: White cheeked Pintail (*Anas bahamensis*), Common Moorhen (*Gallinula chloropus*), American Coot

⁶ Brown, A. C. & Collier, N. (2006). New bird records from Anguilla and St. Martin. Caribbean Journal of Ornithology

Our reference R005-1293149GMC-V05-tsz-NL

(*Fulica americana*), and the regionally endemic Caribbean Coot. All of these species have been documented nesting in the GSP. Yellow-crowned Night Heron (*Nyctanassa violacea*), Green Heron (*Butorides striatus*), Black-necked Stilt (*Himantopus himantopus*), Wilson’s Plovers, Killdeer, and American Oystercatchers (*Haematopus palliatus*) also breed in the wetlands and mangrove areas.

3.13.4 Migratory Birds

The GSP is an important resting place for migratory birds, where they are able to forage on their way south before traveling on. The habitat provides good food and resting places for their journey. Among these migratory birds are several songbirds and many shorebirds from North America and Canada. The GSP provides essential stopover habitat for migratory birds while they travel past the island. The migratory birds and winter guests include a number of birds of prey such as the Peregrine Falcons (*Falco peregrinus – CITES appendix I*), Northern Harriers (*Circus cyaneus*), Merlins (*Falco columbarius*) and Ospreys (*Pandion haliaetus*), all listed on CITES. The large groups of small waders passing through St. Maarten are a food source for the Merlin and the Peregrine Falcon. The survival of migrating birds of prey depends on them being able to find sufficiently large undisturbed hunting grounds and sufficient food. The following 6 migratory birds which have an IUCN status other than Least Concern, have been identified in the GSP area.

Table 3.8 Protected bird species in GSP area

Species	Source	IUCN status	Bird type
Black-bellied Plover (<i>Pluvialis squatarola</i>)	(A)	VU	Migratory bird, not nesting in the region
White-rumped Sandpiper (<i>Calidris fuscicollis</i>)	(B)	VU	Migratory bird, not nesting in the region
Stilt Sandpiper (<i>Calidris himantopus</i>)	(B)	NT	Migratory bird, not nesting in the region
Greater Yellowlegs (<i>Tringa melanoleuca</i>)	(A)	NT	Migratory bird, not nesting in the region
Lesser Yellowlegs (<i>Tringa flavipes</i>)	(A)	VU	Migratory bird, not nesting in the region
Ruddy Turnstone (<i>Arenaria interpres</i>)	(A)	NT	Migratory bird, not nesting in the region

Legend: (A) BROWN & COLLIER, 2008; (B) EBird.org (2013 – 2025); NT = Near Threatened, VU = Vulnerable

3.13.5 Seabirds

Despite the challenges posed by the SWDS/IDS, several seabird species breeds surrounding the GSP including the Brown Pelican, Roseate Tern, Sooty Tern, Bridled Tern, Least Tern, Red-billed Tropicbird, The Magnificent Frigate Bird and Laughing Gull. The Least Terns (*Sterna albifrons antillarum*) nest on sandy areas surrounding the GSP. The endangered Royal Tern (*Sterna maxima*) may breed in the area, as courtship behavior has been observed. Two other endangered

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Tern species, the Sandwich Tern (*Sterna sandwichensis*) and the Common Tern (*Sterna hirundo*) are seasonal visitors.

3.13.6 Bird registrations for the Great Salt Pond

On [Great Salt Pond - Observation.org](http://GreatSaltPond-Observation.org), users can review a map of point observations within the GSP after selecting a species. An examination of most species maps shows that the majority of observations were recorded offshore. The southwestern shoreline and the salt ponds on the eastern side of the GSP appear to be the areas most frequently used by birds. It is unclear, however, whether this reflects actual distribution patterns. The southwestern and eastern parts of the island may simply be surveyed more intensively—for example, because these areas are more accessible or offer better viewing conditions. As a result, the number of recorded point observations in the northern part of Pond island may underestimate the true number of birds present there. Top 5 species recorded are Laughing Gull (*Leucophaea atricilla*), Brown Pelican (*Pelecanus occidentalis*), Western Cattle-Egret (*Ardea ibis*), Black-necked Stilt (*Himantopus mexicanus*) and the Great Egret (*Ardea alba*). An overview of bird species is present in Appendix 7.

3.13.7 Aquatic Fauna and Flora

Very little is known about the composition, distribution and density of aquatic fauna and flora in the GSP wetland. The invasive tilapia or Nile perch (*O. niloticus*) seems to be the dominant fish in the wetland followed by Mullet and Tarpon, respectively. The same goes for the possible presence of algae.

Table 3.9 Indicative overview of aquatic flora and fauna

Common name	Species
Mollusca	
Flat mangrove oyster	<i>Isognomon alatus</i>
Echinodermata	
Cnidaria	
Upside-down jelly	<i>Cassiopeia xamachanna</i>
Porifera	
Pink mangrove sponge	<i>Ecteinascidia turbinata</i>
Black tunicate	<i>Ascidia nigra</i>
Fish	
Mojarra	<i>Gerres cinereus</i>
Juvenile schoolmaster	<i>Lutjanus apodus</i>
Juvenile barracuda	<i>Sphyrna barracuda</i>
Mangrove/grey snapper	<i>Lutjanus griseus</i>
Tilapia	<i>Oreochromis niloticus</i>
Tarpon	<i>Megalops atlanticus</i>

3.13.8 Species of Commercial Importance

No species of flora or fauna of commercial importance were identified in the GSP.

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The consumption of fish, crabs or birds caught in the GSP is discouraged by the Sint Maarten government. Signs prohibiting the consumption of fish were reported to have been placed at approaches to the GSP.

3.14 Archaeological, Historic and Cultural Heritage

The GSP was historically used for salt production, and much of the early development of St. Maarten centred on the salt production and export industry. Salt production continued till the 1940s. The creation of Pond Island since the 1970s has greatly reduced the size and visual appearance of the GSP.

On the SWDS side, large scale Salt Pan structures are no longer visible, with the exception of two structures on the Northern side during low water levels. East of the IDS side, the Salt Pans structure is more clear. The Salt Pans fall under the List of Monuments of Sint Maarten. Since the official registry in 2008 the remaining structures have further reduced due to the expansion of the landfill and other construction activities in the area.



Figure 3.19 Location of Salt Pans in 1916 (source <https://mass.cultureelerfgoed.nl/great-salt-pond-salt pans>)

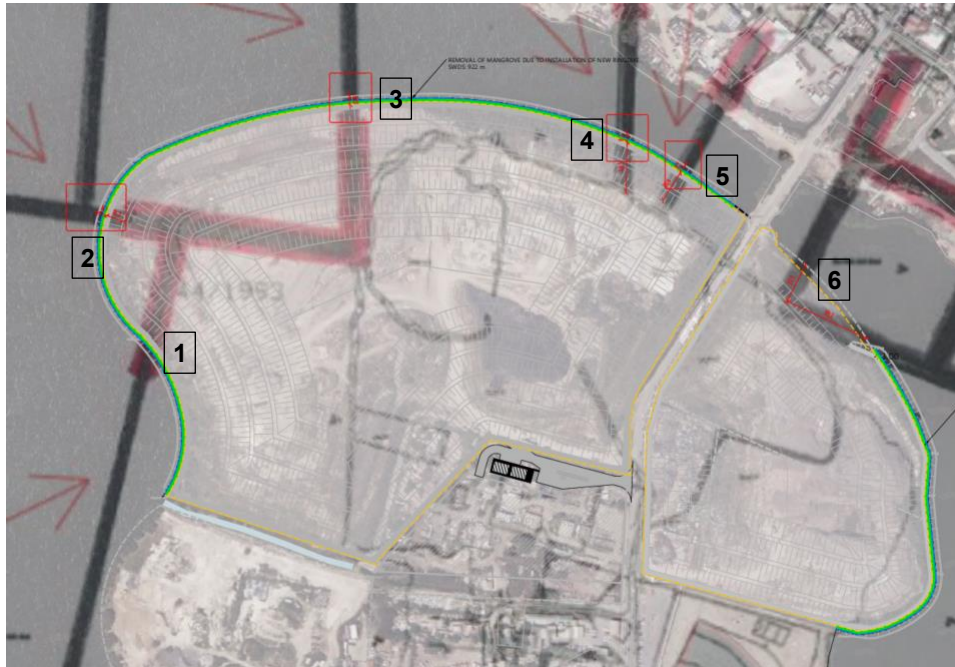


Figure 3.20 Current project area and interaction with Great Salt Pond Monument Status (numbered items)

4 Assessment of alternatives

During the initial project phases, we conducted a comprehensive assessment of primary environmental impacts, specifically focusing on leachate dispersion, the ringdike and landfill gas. This assessment followed the Mitigation Hierarchy, focusing on avoidance, minimization, restoration/rehabilitation and compensation / offset.

Due to the waste body's placement below the average water level of the **GSP**, it remains in direct contact with the groundwater. This issue is compounded by a coarse sandy base layer that functions as an unconfined aquifer.

The evaluation determined that standard extraction and treatment of the leachate inside the waste body were impractical for the following reasons:

- **Hydraulic Inefficiency:** Extraction would trigger a preferential flow from the GSP to the extraction points, resulting in the treatment of the salt water from the GSP rather than concentrated leachate
- **Prohibitive Costs:** While installing a sheetpile perimeter to prevent inflow from the GSP is technically viable, the scale required—approximately **4 km** in length reaching depths of **20 m**—was deemed economically unfeasible

In this situation, avoidance of leachate generation and dispersion was not seen as realistic and primary focus was on minimization of leachate generation. Consequently, the solutions shifted toward prevention of leachate generation through the installation of an impermeable top cover to minimize rainwater infiltration, thereby significantly reducing leachate generation and subsequent migration into the GSP.

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Establishing a functional ring road was identified as a critical requirement for future operations and maintenance. As the installation of the new ring road could not be avoided two alternatives were considered:

1. Clearing the existing road (which would unacceptably reduce landfill capacity).
2. Constructing a new ring dike within the GSP.

To preserve the necessary disposal volume, the decision was made to proceed with the construction of a new ring dike within the GSP. Measures then focussed on minimization of impacts on the archaeological structures where possible through using parts of the existing ringdike where possible and restoration and rehabilitation of mangroves affected to restore areas for nesting birds

Landfill Gas generation could not be avoided in the landfill site, however modelling of gas generation indicated that the potential yields are insufficient for economically viable energy recovery. Historical intensive burning, particularly in deeper layers, has significantly depleted the organic matter required for gas formation. To optimize long-term operational costs and eliminate the risk of mechanical failure, a passive system with collection and treatment was seen as most realistic in order to minimize impacts of the LFG on the environment.

Taking these considerations into account, the following alternatives have been considered in the Analysis and Selection of Alternatives for MSWDS development (Witteveen + Bos Ref. 25-006.096, 20 March 2025):

- Alternative 1: Existing Boundaries
- Alternative 2: Extension at Resettlement Area (RAI)
- Alternative 3: Extension at the VROMI yard

In addition, two sensitivity cases have been applied; with IDS height at 10m or 25m. Not closing the MSWDS has never been an alternative, as one of the objectives of EDMP's landfill interventions is to close IDS and SWDS.

The engineering concept for improving the Environmental, Health, and Safety conditions was applied uniformly across all alternatives. In other words, the technical solutions for leachate management, landfill gas treatment, stormwater management, and related systems are identical for each option. Consequently, any differences in environmental or social impacts result solely from the spatial distribution of the respective alternatives.

As part of the Feasibility Criteria and Boundary Conditions (TAUW report R004-1293149IKR-V01-mvg-NL) environmental, health, and safety (EHS) criteria were evaluated how the MSWDS upgrade will influence ecosystem integrity, human health, and community quality of life by examining impacts on air and water quality, leachate behaviour, operational emissions, and overall risk management. These criteria consider the required setback distance between residential areas and the landfill extension to prevent exposure to gaseous emissions and ensure compliance with international standards; the effectiveness of greenhouse gas collection and processing systems; and the degree of dust and other airborne emissions generated during construction and operation. They also assess the risk of landfill fires based on operational practices and mitigation measures, as well as the ability of the upgraded system to reduce the

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toxicity, mobility, and volume of leachate migrating toward the Great Salt Pond, where contamination currently poses unacceptable health risks for direct contact activities such as fishing and swimming.

Additional criteria address odour and noise impacts on surrounding communities, the extent to which landfill operations protect or enhance bird habitats in the Great Salt Pond area, and the efficiency of land use—an essential factor in land scarce Sint Maarten—ensuring that the upgraded facility minimizes its footprint while supporting future waste management initiatives.

Finally, the criteria evaluate the sustainability of raw and cover materials, including whether recycled or repurposed materials are used to reduce environmental impact. A summary of the outcomes for the three alternatives is presented in Table 4.1.

Table 4.1 Overview Evaluation and Ranking Alternatives for Technical Feasibility Criteria

Criteria	Existing Boundary	Resettlement Area	VROMI Yard
Set-Back Distance	Moderate	Moderate	Poor
Air Quality	Very Good	Good	Good
Landfill Fires	Good	Good	Good
Toxicity, Mobility or Volume of Leachate Migration	Good	Moderate	Moderate
Odour and Noise	Moderate	Poor	Poor
Impact on Bird Nesting and GSP Flood Capacity	Moderate	Moderate	Poor
Land-Use Efficiency	Very Good	Good	Moderate
Sustainable Resources and Raw Materials	Poor	Poor	Poor

In conclusion, while the existing boundaries exhibit superior performance across most criteria, the Resettlement Area alternatives provide essential waste capacity that is necessary given the expectations for the landfill to remain operational until 2032. The extension of landfilling at the VROMI Yard is regarded as the least feasible option due to its higher environmental and socio-economic risks, while only providing limited additional waste disposal capacity.

After consultations with key-stakeholders on the possible alternatives, the vertical design boundaries for the MSWDS consisting of a maximum waste height of 36m at the SWDS and 24m at the IDS with minimal extension to the former resettlement area, is the preferred option. This extension of less than 10 % of the resettlement area was agreed in September 2025.

Additionally, from social perspective, all three alternatives require the resettlement of three entities that are operational and/or hold long lease agreements in SWDS or IDS. The full extension into RAI (Alternative 2) or VROMI yard (Alternative 3) would trigger additional resettlement of residents and businesses located immediate south of RAI and east of VROMI yard. To ensure safety of these community members, a set-back distance of at least 30m from the SWDS crest would have to be enforced. By limiting the extension up to 10 % of RAI, the set-back distance from the community is maintained without additional resettlement. As a result, the resettlement has been minimized to three entities on the MSWDS.

5 Assessment of Environmental and Social Impacts and Risks

This section describes the predicted environmental and social impacts arising from the project components and associated activities related to:

- SWDS Slope recontouring and closure including slope stability improvement
- IDS recontouring and closure
- Installation of auxiliary buildings
- Resettlement of two businesses in VROMI yard

These activities have been assessed for potential environmental and social impacts and risks to determine any direct and indirect impacts between the activities and the nearby environmental resources, communities, commuters, and businesses. The ESIA also predicts and quantifies to the extent possible the magnitude of impacts and risks for each of the project activities. For this ESIA, risks are based on the following considerations:

- Type of impact (positive or negative)
- Nature of the change (what is affected and how)
- Size, scale, or intensity (low, moderate, significant)
- Duration and/or frequency (e.g., temporary, short term, long term, permanent)
- Cumulative (yes or no)

The magnitude of impact describes the actual change that is predicted to occur and in the case of adverse impacts, without mitigation measures it is ranked from slight or none, moderate, significant to high. It is also imperative to identify positive impacts. The ESIA is presented in Table 5.1. For the magnitude of impact:

- During Activities concerns the period when on-site activities take place
- Operational concerns the period after finalization of the on-site activities
- Magnitude of impact with mitigation, concerns the impact when mitigation measures are taken into account

5.1 Environmental and Social Impact Assessment

The content and extent of the environmental and social impacts which needed to be addressed in this ESIA have been identified through research and scoping. This helps to ensure that the environmental information used for decision making provides a comprehensive picture of the effects of the project, including issues of particular concern to affected groups and individuals.

Meetings, special studies and consultations were carried out as part of the original ESIA and this update to ensure that comprehensive information is available on the involved stakeholders and their interests in the project components. The potential environmental and social impacts will be addressed as well. An updated [Environmental and Social Management Plan \(ESMP\)](#) is available where the details of the mitigation measures are presented.

5.1.1 Social Impact

In February 2024, all residents and businesses moved out of RAI, and all structures were vacated. RAP implementation was concluded in September 2025, when those PAPs who originally opted for in-kind compensation were fully resettled.

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This action followed the findings of a 2020 site survey by EE&G and Hammer Consulting, which highlighted ongoing slope stability issues despite previous mitigation efforts. The relocation was crucial to ensure the safety of residents and businesses, particularly those near the unstable slopes.

The following potential specific social impacts as a result of the MSWDS Landfill management project have been identified:

- Resettlement of three entities. Two commercial entities will be relocated in VROMI yard. For the Association, the Government will provide replacement land (detailed in the Abbreviated Resettlement Action Plan, ARAP, which is being prepared)
- Residents, businesses and educational centres, leisure facilities and government activities on Pond Island and road users (i.e., community members, tourism operators, and visitors) between Pond Island and the port facilities will be affected by noise, dust, and traffic during construction phase
- Waste pickers. There still are waste pickers at the landfill, despite being compensated by the RAP and offered transition measures under the LRP, which were prepared and implemented for the RAI. While the landfill will be fenced for security and safety, there are health and safety risks as they may access landfill through certain re-opened sections (detailed in Section 5.1.10)

During operation phase, residents and businesses located near VROMI yard will be affected by noise, dust, and traffic in and out of VROMI yard, due to crushing operations by the two commercial entities. The activities of two commercial entities are closely connected to waste management and recycling. For Steel Crushers B.V., the IDS rehabilitation, restoration and/or closure will require the relocation of their business, which may result in a (temporary) loss of income. The facility of Windward Road B.V. on the SWDS will also need to relocate due to the planned SWDS slope recontouring and closure including slope stability improvement. The loss of income is not foreseen for WWR. The exact impact and mitigation measures will be detailed in an abbreviated resettlement action plan (ARAP). The relocation of both facilities, if properly designed and set-up, is expected to have positive benefits, such as better soil and groundwater protections, improved work health and safety due to chance for restructuring of site and renewed compliance with permits (detailed in Section 5.1.15).

A socioeconomic survey is being carried out for the three entities to assess the impact of resettlement, including potential loss in income, assets, entitlements, etc. As a mitigation measure, the NRPB will prepare and implement an Abbreviated Resettlement Action Plan (A-RAP), including a LRP, prior to the commencement of civil work.

During the construction phase of the project, residents, educational facilities, government facilities, leisure facilities and businesses on Pond Island and along Juancho Yrausquin Blvd, Walter A. Nisbeth Road between Juancho Yrausquin Blvd and the roundabout with Soualiga Road will be impacted by the activities through increased traffic, dust and noise. The movement of the facilities of Steel Crushers Bv and Windward Roads Bv will result in a change in traffic pattern in the area south of the landfill and different source areas for noise and dust generation. These are detailed in Section 5.1.15.

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5.1.2 Air Quality

Reprofiling the landfill and transporting soil and rock to the landfill mass will be significant sources of dust and various air pollutants, including particulate matter (PM), volatile organic compounds (VOCs), and greenhouse gases.

In addition, during the construction phase of the reprofiling and recontouring there is an increased risk of fires and associated smoke as oxygen levels in various waste layers will increase when exposed to outside air.

This might increase potential inhalation and skin contact hazards to the contractor, government and landfill contractor employees working at the SWDS and IDS. The reprofiling and recontouring methods chosen, as well as the associated fire suppression activities will impact the magnitude of the potential air emissions exposure scenarios.

Based on the calculations the current (2024) yearly methane generated in the landfill is around 1,453 tonnes of CH₄ and the peak of CH₄ generation will be reached in 2027 with 1,593 tonnes of CH₄. During Slope recontouring the amount of released landfill gas might temporarily increase as pressure gradients and oxygen levels change. After installation of the final top cover, landfill gasses are collected and treated, reducing overall releases to the environment.

A synthetic (LLDPE) permeability barrier will prevent LFG accumulation, necessitating passive gas extraction through a network of perforated HDPE drains and a biofilter filled with compost material to oxidize methane effectively, at an estimated 60 % efficiency.

5.1.3 Odor

Site reconnaissance of the MSWDS conducted by EE&G in 2017, 2018, and 2019, revealed that the smoke associated with the SWDS and IDS Site fires had a strong smell that can be described as acrid, or that of burnt rubber or plastic. The RIVM report⁷ also indicated the presence of unpleasant odour on several occasions, originating from the landfill although no specific locations were mentioned. It is expected that during recontouring of the IDS and SWDS, additional odour nuisance will arise, especially when working in part of the semi-saturated waste bodies. This odour, with a sulfuric smell should be further controlled and mitigated as it may cause sensitivity reactions in susceptible individuals.

Studies indicate that individuals living at least 2 kilometres away from a landfill may still experience health and environmental effects compared to those residing farther away⁸. The negative impact, including odour and noise, are further amplified during the reprofiling of the wastes. The predominant wind direction is towards the West, resulting that the receptor in this direction are more affected by the construction and operational activities. Horizontal spreading of odors is primarily driven by wind and turbulence, which carry and disperse the odor molecules horizontally. The shape of an odor plume is often irregular and influenced by wind speed and direction, terrain features, atmospheric stability and source height. Considering that the MSWDS is situated in a valley, odour will remain within the boundaries of the ridges of the surrounding hills.

⁷ Investigation of the air quality around the landfill Sint Maarten 2019 (RIVM report 2019-0056)

⁸ Njoku, Edokpayi, and Odiyo (2019) Health and Environmental Risks of Residents Living Close to a Landfill: A Case Study of Thohoyandou Landfill, Limpopo Province, South Africa, Environmental Research and Public Health, 15 June 2019, Volume 16, Issue 12

Our reference R005-1293149GMC-V05-tsz-NL

The width of the GSP on the western side of the landfill is the greatest, limiting the impacted neighbouring areas. A general estimate of spreading is indicated in the following figure.

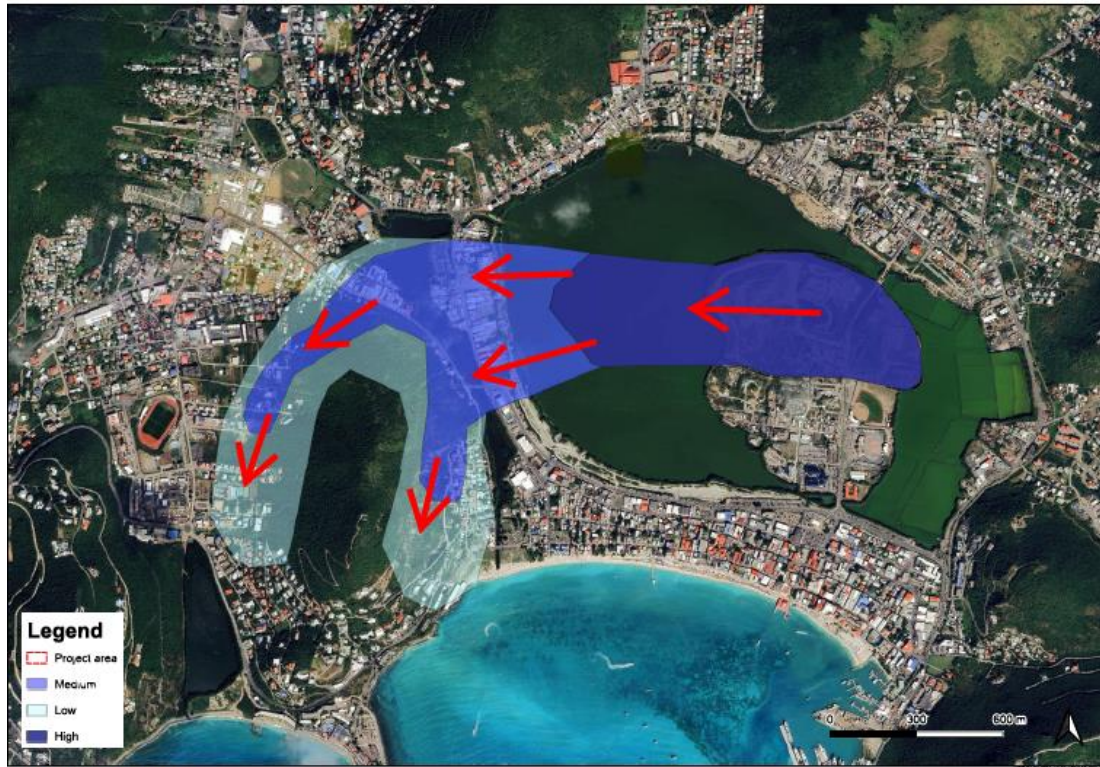


Figure 5.1 Dispersion patterns of odour and dust based on wind flow patterns of RIVM (2019)

5.1.4 Dust

Site reconnaissance of the SWDS and IDS Site, and surrounding neighbourhoods, conducted by EE&G in 2017, 2018, and 2019, revealed that dust control practices were minimal. Dust was most visible at work/landfilling locations and on vehicular roadways. Excavation of burned wastes particularly generated dust (Environmental Field survey Report, R002-1293149ABR-V03-mvg-NL, Witteveen+Bos and TAUW, November 28th 2024). Concentrations of PM10 at the SWDS Southern border exceed 24 hrs limit levels during one day of monitoring over a period of 2 weeks during the RIVM investigation⁹ in 2019. Other monitoring stations did not show an exceedance of PM10 during the monitoring period.

It is expected that both the SWDS Slope recontouring and closure including slope stability improvement and the Irma debris disposal site rehabilitation, restoration and/or closure will generate significant dust during the operational phase from the movement of the wastes and existing top covers. Mining and processing of wastes for the production of aggregates will generate further dust in the areas of operation and at the contractor yard.

⁹ Investigation of the air quality around the landfill Sint Maarten 2019 (RIVM report 2019-0056)

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In addition, increased traffic to and from the port will increase dust formation on the main vehicular roadways. The movement of existing facilities of Wind Ward Roads and/or Steelcrushers to a new location (VROMI yard), will result in a shift in the location where dust will be generated. The most affected would lie directly west of the MSWDS, in line with the areas most affected by the odour.

5.1.5 Roads and Traffic

Soualiga Road serves as the only access road for the SWDS and IDS Site. It runs in a north south direction across Pond Island separating the SWDS and IDS Site. Entrances to the SWDS and IDS Site from Soualiga Road are through a small narrow dirt road (Brine Drive) and an unnamed dirt road, respectively. In order to be protective of health and safety of the community members, consideration should be made to control access to Soualiga Road from the south end of the RAI to the north end of Pond Island. The only alternative traffic route, via Suckergarden Rd and Arch Rd. is 1 km longer and would pass by more residential areas.

During the construction phase, especially for the SWDS Slope recontouring and closure including slope stability improvement and the Irma debris disposal site rehabilitation, restoration and/or closure, significant additional traffic will move between the port facilities and the landfill. Required soil volume for recontouring only is 205,000 m³ which translates to 10,250 truck movements between the landfill and the port facility (round trips, based on 20 m³ dumper trucks). The movement will lead to increased traffic noise, potential for accidents, road damage and littering during waste transit. It will have an adverse impact on the traffic coming from the port (cruises) during the high season. Detailed traffic and logistics planning (especially for material importation) may be refined once D&B Contractor has been appointed, taking into consideration existing congestion and cruise ship traffic. Route and schedule optimization will be addressed as more operational data becomes available.

The actual soil volume needed can be reduced due to the proposed aggregate recycle actions. The transfer of wastes and materials from the SWDS to the IDS side of the MSWDS during reprofiling and closure will increase the cross-traffic over Soualiga Road. Movement of Steel Crushers and/or WindWard Roads to the VROMI yard will divert some of the traffic from the main road to the area South of the MSWDS.

5.1.6 Noise

As no baseline noise measurements are available for Pond Island, a baseline is to be established by the D&B contractor prior to the start of the works. Current noise impact predictions rely on source levels and propagation assumptions. Re-location of facilities within the (vicinity of) the MSWDS, more specifically the rock crushing and steel crushing facilities, will lead to a different noise distribution in the area. Rock crushers poses serious noise levels with noise pressure up to 90 dB(A) at 10 m from crusher. Considering this maximum noise pressure level, and activity duration of 8 hours, the acceptable level of 55 dB(A) (night time) for Close to main roads, in urban areas with some commercial activities is exceeded in a proximity of 60 meters from the crushers, assuming that the facility is a single point source and no sound barriers are installed.

Our reference R005-1293149GMC-V05-tsz-NL

Figure 5.2 contains the noise buffer around the landfill site. The entire project areas has been chosen as the rock crusher will likely be moved during the operations to be closer to the source areas.



Figure 5.2 Map with the maximum extent where noise levels are exceeding 55 dB(A) assuming all activities are a single point source. Area in red is closest houses

A metal recycling facility or scrap yard can result in a maximum noise pressure up to 90 dB, with an average noise level in the order of 80 dB¹⁰. Considering this maximum noise pressure level, the acceptable level of 55 dB for close to main roads, in urban areas with some commercial activities (night time) is exceeded in a proximity of 60 meters from the recycling activities, assuming that the facility is a single point source and no sound barriers are installed. To the South-East of the former resettlement area, housing and housing containers are present. These dwellings would fall with the 60 m buffer zone in case the metal recycling facility or rock crusher would be positioned at the edge of the project site.

Additional noise is further expected from the traffic to and from the site for the delivery of the cover materials needed for SWDS Slope recontouring and closure including slope stability improvement and the Irma debris disposal site rehabilitation, restoration and/or closure. The movement of existing facilities to a new location, will result in a shift in the location where noise will be generated.

¹⁰ Occupational Noise Exposure in Scrap Steel Recycling Industry, Okedere, Oyetunji Babatunde, New York Science Journal, 2011;4(8)

Our reference R005-1293149GMC-V05-tsz-NL

5.1.7 Geology and Soils. Slope Stability

The design for the closed SWDS and IDS takes into account slope stability under normal circumstances and heavy rainfall events.

Based on available data, during an earthquake, the clay silty layer underneath both the IDS and SWDS loses its strength and long slip circles underneath the landfill form in this layer. In the case of IDS and SWDS this risk involves the following:

- People present on the landfill and inside the set-back zone during an earthquake event
- People living along the shores of the GSP during an earthquake event

The probability of an earthquake occurring in this area is generally much lower than the probability of extreme rainfall. The required unrealistically faint slope to remain stable cannot be achieved without significant removal of wastes from the area. Calculations show that the debris from earthquake slope failure would remain within the set-back zone on the landward part of the SWDS and IDS.

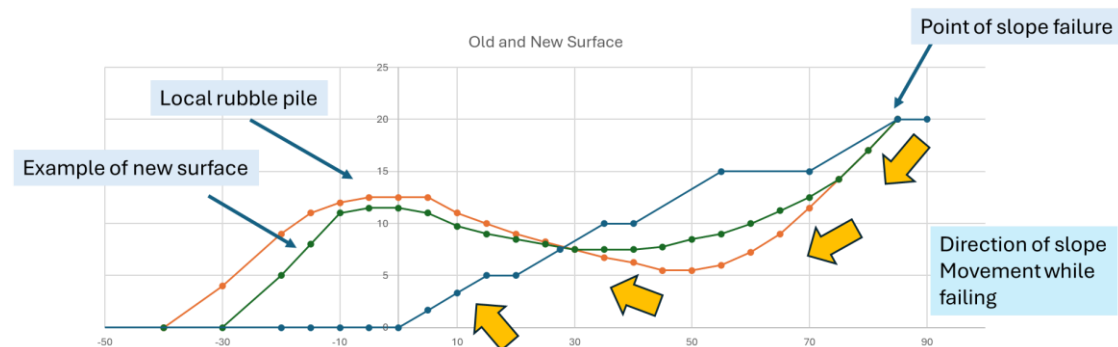


Figure 5.3 Calculations on potential slope failure on landward parts of the SWDS and IDS

It should be noted that the loss of strength of the clay/silt layer underneath the landfill will not only affect the SWDS and IDS but most likely also all other structures not constructed on strong foundations on Pond Island and the shores of the GSP.

Within the contour of the current SWDS and IDS, contamination of the soil underneath the waste mass will continue through dispersion of leachate. The current Steel Crushers B.V. site is possibly contaminated with Total Petroleum Hydrocarbons due to the storage of car wrecks on the original soil. In the VROMI yard, the auxiliary buildings and possible re-location of Steel Crushers B.V. can have a negative impact on the soil quality. Processing of car wrecks may lead to the contamination of the soil with brake fluids, engine oil, gasoline and heavy metals. The import of large quantities of soil bring with it the risk of chemical and biological pollutants to be brought into the site.

5.1.8 Hydrogeology, Hydrology, and Surface Water Quality

There is a clear environmental impact of the groundwater by the leachate coming from the landfill. The absence of a liner results in the direct contact of the leachate and wastes with the water from the GSP resulting in an equilibrium between the contaminated groundwater and the GSP with additional discharge to the GSP during periods of low water levels and dilution of the contaminated groundwater during periods of high water levels as can be seen in Figure 3.17 Leachate interaction with main channel.

Our reference R005-1293149GMC-V05-tsz-NL

During slope stabilization and recontouring of the SWDS and IDS, the opening of old sections of the landfill can, during periods of heavy rainfall, lead to a temporary increase in leachate generation as the unsaturated zone will be reduced. In addition, surface run-off from exposed areas can become contaminated and discharge to the GSP.

The installation of a new cover will lead to an increase in suspended sediments in the surface run-off until the cover is vegetated. This increase in suspended sediments will cause a temporary turbidity increase in the GSP at the outlet points.

After implementation of the activities, the impact of the SWDS and IDS on the GSP and groundwater will be reduced through:

- Limitation of infiltration of rainwater into the landfill body
- Re-routing of surface run-off to prevent mixing with leachate
- Reduction of sediment load of surface run-off through vegetation of slopes

However, due to the subsurface characteristics of the site, not all leachate can be prevented and continued impact on the GSP will remain. It is expected that after final closure, the volume of leachate generated can be reduced by over 80 %.

The installation of the new ring dike will temporarily impact the water quality of the GSP as the construction activities will disturb the sediments, further increasing turbidity. Disposed materials can leach, leading to deterioration of water quality.

5.1.9 Ecology

The ecological environment of the GSP is under stress due to overdevelopment of the surrounding areas. The GSP is impacted by sewage runoff from the surrounding neighbourhoods. In addition, stormwater runoff and groundwater, originating from the SWDS and IDS, discharges directly into the surrounding the GSP. This can have adverse impacts on existing flora and fauna. During the construction phase, a temporary increase in leachate generation is possible as the SWDS and IDS will be partially reopened.

During the SWDS Slope recontouring and closure including slope stability improvement and the IDS rehabilitation, restoration and/or closure, a new ring dike, to allow for access, will be established. This new ring dike will require the removal of part of the existing (mangrove) vegetation along the SWDS and IDS waterfront. The total shoreline length of the Great Salt Pond, most of which is covered with Mangroves is approximately 8,5 km (see Figure 5.4). In total 922 m of mangroves (majority a single line of trees) will be removed along the SWDS side of the project and 338 m will be removed along the IDS side, leaving a section of mangroves in place on the Northern end, around Salt Pan feature 6 (see Figure 3.20). As such, during the project, ~15 % of the mangrove vegetation on the shore of the Great Salt Pond will be cut and replaced. These activities can affect the terrestrial and aquatic flora and fauna during the operational phase. As only very limited information is available on the aquatic communities in the GSP, the exact response of the aquatic flora and fauna to the works is uncertain.

Our reference R005-1293149GMC-V05-tsz-NL

Direct impact on the bird life population is mostly expected on breeding birds. No impact on bird foraging and resting, including any vulnerable and near threatened species is expected as the area exhibits sufficient alternatives in resting areas (Mangroves, Salt Pan dikes) and foraging (remaining parts of the landfill in operation during initial construction). Contractor is expected to monitor nesting birds in the area and adapt schedules/operations to limit impacts.



Figure 5.4 Great Salt Pond Boundary

The introduction of large quantities of soil from outside Sint Maarten brings with it the risk of introducing non-native species, especially soil biota and fungi. Sourcing of materials should be traceable and local or regional where possible.

After the construction works are complete, the implemented measures will result in an overall improvement of the ecological status as the influx of contaminated leachate will be reduced by up to 80 % and remaining steel and stone crushing activities will be more controlled reducing dust levels and improving air quality. The installation of a new mangrove network along the waterfront and re-vegetation of the closed (parts of) the landfill will reinstitute and/or improve on the situation after the construction phase. The species to be seeded should be appropriate to the flora of Sint Maarten (i.e. be considered native and not introduce new or invasive species) thus creating grassland habitat for insects, birds and small fauna, increasing local biodiversity compared to the near-zero habitat value of the active dump. The Mangrove revegetation should re-establish shoreline ecological functions, such as breeding habitats for birds.

Our reference R005-1293149GMC-V05-tsz-NL

5.1.10 Worker Health and Safety

During construction, workers are subject to direct exposure to hazardous materials. Since there has been no alternative to the landfilling of hazardous wastes, the presence of hazardous materials inside the waste body cannot be excluded. Considering the limited industrial facilities present on the Island, the most likely hazardous wastes include asbestos containing materials, waste oils and house hold chemicals. Especially during slope recontouring or waste processing, when new or existing wastes are handled workers can come into contact with adverse materials. In addition, non-hazardous wastes present risks due to sharp objects being present and increased risk for tripping and falling due to uneven surfaces.

Sloping and recontouring activities will increase dust formation, potential for landfill fires flaring up with associated hazardous air emissions as well as temporary, small scale, slope instability. Staff working closely to the exposed surfaces will be exposed to these risks.

Main risks for worker health and safety are associated with the increase vehicular traffic on and off-site due to the large volume of material needed for the landfill cover and the movement of heavy loads and machinery. The slopes that the machinery needs to work on will further increase risk of toppling or dangerous manoeuvring. Additionally, working near water increase risks of drowning, as workers will need to be present along the waterfront.

Risks for explosions or spontaneous combustion due to the presence of landfill gases and disposed chemicals is not seen as a major risk as the sloping and contouring activities are focused on the aerobic parts of the waste body and no evidence of large scale disposal of chemicals is present. Furthermore, the risk of methane gas build-up in enclosed spaces is limited as no buildings are envisaged on the landfill site. Site staff involved with the installation of the LFG collection system are required to handle higher risks for gas build-up and associated risks. Nonetheless localized methane accumulation or sudden gas releases during excavation or regrading works is not negligible and will need to be managed.

The continuation or increase in waste picking during the activities cannot be excluded as the re-opening of certain sections of the landfill will increase opportunities for collection of recyclables. Waste pickers will be exposed to health and safety risks, such as hit by vehicles/equipment, dust inhalation, contact with hazardous materials.

5.1.11 Public Health and Safety

Main issues for public health and safety are associated with the construction phase and lie with increase dust formation during slope recontouring and reshaping, increased dust formation due to an increase in vehicular traffic and potential for landfill fires flaring up with associated hazardous air emissions through smoke and dust emissions.

Considering the prevailing easterly winds, the bulk of the emissions will move west, towards the GSP although passing traffic will also be affected especially during IDS slope recontouring and reshaping activities.

Our reference R005-1293149GMC-V05-tsz-NL

The increase in activities on the SWDS and IDS can shift vermin patterns, leading to an increase in vermin in the areas surrounding the landfill.

A strong increase in vehicular traffic between the port facilities and the SWDS and IDS is also expected, especially when shipments of soil cover arrive. Together with the increase in traffic and heavy loads between the IDS and SWDS of the landfill would lead to an increase in possible traffic accidents. The heavy loads of the vehicles involved further increase the risk of injury or death compared to regular traffic.

5.1.12 Aesthetic Affects

Both the IDS and SWDS will be recontoured and largely closed. The crest level of the SWDS is set at 36m above Sint Maarten Peil (average sea level), which is slightly below maximum crest level as established in August 2024. However, the crest in the new situation will be much bigger. For the IDS side maximum crest level will be 24m above Sint Maarten Peil, which is slightly above current maximum height. The final closure of the landfill will re-instate a more natural look to the area, greening the area with native vegetation. The installation of new mangroves along the ring dike will reinstate a more natural shoreline. The future site as such will have a more appealing look compared to the August 2024 situation.

5.1.13 Archaeological, Historic, and Cultural Heritage

The GSP was historically used for salt production, and much of the early development of St. Maarten centred on the salt production and export industry. Salt production continued till the 1940s. The creation of Pond Island since the 1970s has greatly reduced the size and visual appearance of the GSP.

The installation of a new ring dike will further reduce the open area of the GSP, with approximately 2,500 m² on the IDS side and 5,000 m² on the SWDS side. The design of the works in the vicinity of the designated salt pans heritage monument has been carefully considered, to minimize impacts on the designated features. The sections of wall that are closest to the project are however not the best examples of salt pan walls, since they have been affected previously such that they no longer represent the entire salt pan feature. Of the six Salt Pan structures indicated in Figure 3.20 the impacts of the project are:

- Section 1: No impact, this section of the Salt Pans was already removed prior to the Monument Status
- Section 2: This section of the Salt Pans is generally not visible, 16.3 m length is below the current landfill and the new ring dike will cover an estimated additional 8.1 m in length
- Section 3: This section of the Salt Pans is generally not visible, the new ring dike will cover an estimated additional 8.1 m in length
- Section 4: This section of the Salt Pans is visible during low water levels, 46.1 m length is below the current landfill, the new ring dike will cover an estimated additional 8.3 m in length
- Section 5: This section of the Salt Pans is visible during low water levels, 30.6 m length is below the current landfill, the new ring dike will cover an estimated additional 8.1 m in length
- Section 6: This section of the Salt Pans is clearly visible, 37.7 + 80.2 m in length is below the current landfill, no additional encroachment will take place in this section

Our reference R005-1293149GMC-V05-tsz-NL

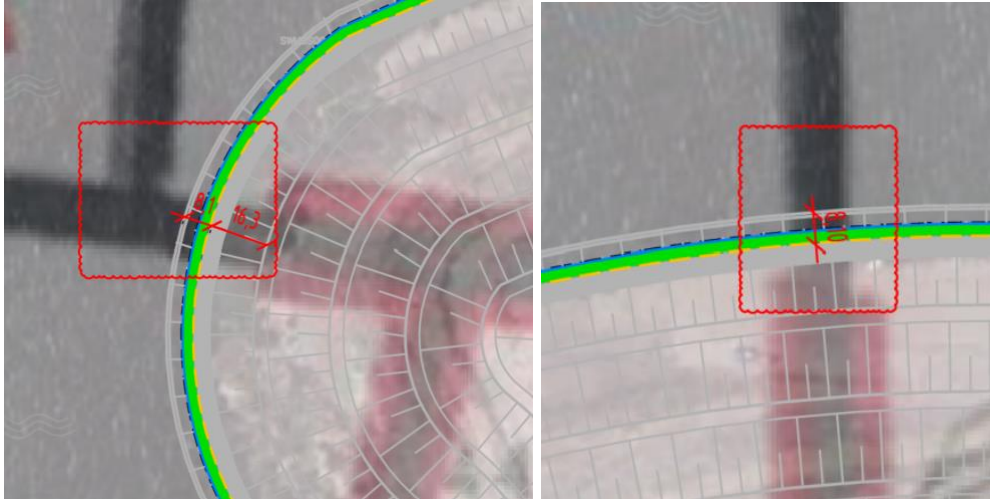


Figure 5.5 Encroachment on Salt Pan Features 2 and 3

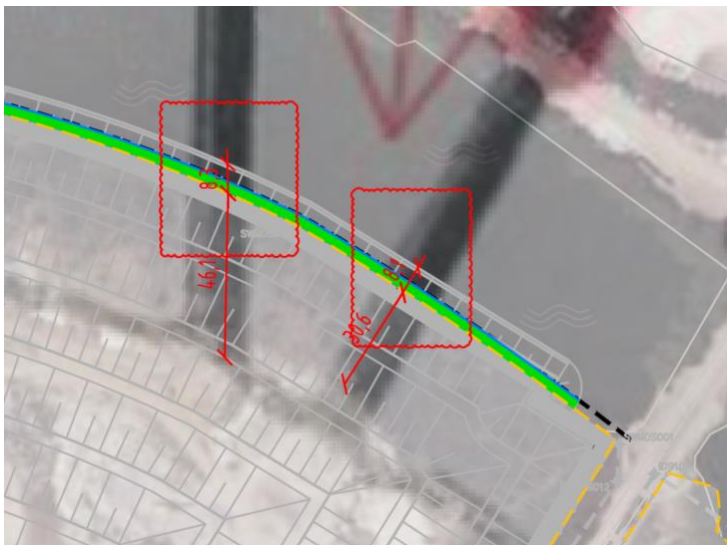


Figure 5.6 Encroachment on Salt Pan Features 4 and 5

On the IDS side, the current landfill is already covering part of the Salt Pans at section 6, in these parts, the future ring dike will be constructed slightly inland as to prevent further encroachment (see Figure 5.7). On the SWDS side, Salt Pan structures are only occasionally visible on the North side during periods of low water. The best examples of entire salt pans are along the eastern edge of the designated site and will remain unaffected by the works.

Our reference R005-1293149GMC-V05-tsz-NL



Figure 5.7 Salt Pan features and ring-dike at section 6

The salt pans monument features will not be affected by the ring dike works on the IDS side, on the SWDS side the Salt Pan features will be crossed by the ring dike.

5.1.14 Natural Disaster Risk

The recontoured SDWS and IDS will take into account slope stability under normal circumstances and heavy rainfall events (increase of groundwater levels centrally on the landfill with 2 m relative to the August 2024 status), reducing the risks for slope failure compared to the current status. Based on available data, during an earthquake, the clay silty layer underneath both the IDS and SWDS loses its strength and long slip circles underneath. This situation is no improvement nor worsening compared to the current status.

Construction of the ring dike and closure of the landfill are estimated to reduce the buffering capacity of the GSP by approximately 18,740 m³, corresponding to a theoretical water level rise of 1.7 cm. The reduction in infiltration caused by landfill closure is expected to increase direct runoff by 9,285 m³ during the highest recorded daily rainfall event since 2018 (105.8 mm), resulting in an additional water level rise of 0.8 cm. Combined, these effects cause a total theoretical peak water level increase of approximately 2.5 cm during extreme rainfall events. Due to the reduction in buffering capacity an increase in surface run-off, the critical water level in the GSP can be reached earlier and the anticipated pump system from the Rolandus Canal will need to start pumping earlier. With a capacity of 7,800 m³/hour the pump has sufficient capacity to deal with the reduction in buffering capacity, requiring an estimated additional 3 hours of pumping to fully dewater the reduced buffer capacity and increased inflow and as such there is no indication that this 2.6 cm rise in water levels will occur.

Pending the installation of the new pumps towards the Rolandus Canal, the buffering capacity of the GSP can be controlled through the inflow of water from the Freshwater pond, in case of heavy rainfall events, the Freshwater Pond has a crude, alternative outfall towards the Great Bay, allowing a reduction of the inflow of water towards the Great Salt Pond and limiting the water level increase. As such no increased risk for flooding due to the reduction in buffering capacity of the GSP is expected. Appendix 6 contains the associated calculations.

Our reference R005-1293149GMC-V05-tsz-NL

The proposed ring dike does not obstruct the culvert in the Northern Passage and therefore does not reduce hydraulic transport capacity through the culvert.

5.1.15 VROMI Yard

Steel Crushers and WWR will be resettled in VROMI yard as an integral part of the Government of Sint Maarten's waste management strategy. The Government plans to allocate the equivalent size of land for the two businesses that they currently operate in IDS or SWDS. Community health and safety risks and impact during resettlement and operation phase will include noise, dust, soil pollution, stockpiling, and traffic. The ESMP details mitigation measures. The measures will be further refined by a VROMI yard site plan to be prepared by VROMI/NRPB, including exact resettlement locations for two entities and traffic and logistics planning.

Table 5.1 Environmental and Social Impacts construction phase

Impact Category	Nature of the change	Type of impact (+) positive (-) negative	Size/ Scale/ Intensity Low = L Moderate = M Significant = S	Duration/frequency Short term = ST Long term = LT Permanent = P	Cumulative Yes No	Mitigation / Management Necessary	Magnitude of Impacts		
							During activities without mitigation	Operational phase	Magnitude of Impact 'With Mitigation' during activities
Social Impact	Impact on two businesses operating on the IDS and SWDS	-	S	ST	No	Yes	Significant	Positive	Moderate
	Loss of land lease for Sint Maarten Soccer association	-	L	ST	No	Yes	Moderate	Positive	Moderate
	Waste pickers (waste picking during construction phase. See workers health and safety for specific risks)	-	L	ST	No	Yes	Significant	Significant	Significant
Air Quality	Smoke impacts	-	M	LT	Yes	Yes	Significant	Slight or none	Moderate
	Landfill gases	-	M	LT	Yes	Yes	Significant	Slight or none	Significant
Odor	Odor impacts	-	M	LT	Yes	Yes	Significant	Slight or none	Moderate
Dust	Dust impacts from sloping / re-contouring	-	S	LT	Yes	Yes	Significant	Slight or none	Moderate
	Dust impact from increased traffic (construction and operation phases)	-	M	LT	Yes	Yes	Moderate	Slight or none	Moderate
	Dust impacts from crushers / shredder in VROMI yard (operation phase)	-	M	LT	Yes	Yes	Moderate	Moderate	Moderate
Roads and Traffic	Existing loading and traffic congestion	-	M	LT	Yes	No	Moderate	Slight or none	Moderate

Impact Category	Nature of the change	Type of impact (+) positive (-) negative	Size/ Scale/ Intensity Low = L Moderate = M Significant = S	Duration/frequency Short term = ST Long term = LT Permanent = P	Cumulative Yes No	Mitigation / Management Necessary	Magnitude of Impacts		
							During activities without mitigation	Operational phase	Magnitude of Impact 'With Mitigation' during activities
	Increased traffic loading and traffic congestion during the recontouring and closure activities	-	S	ST	Yes	Yes	Significant	Slight or none	Significant
	Air quality impacts from vehicle emissions	-	M	LT	Yes	Yes	Moderate	Slight or none	Moderate
	Traffic noise	-	M	LT	Yes	No	Moderate	Slight or none	Moderate
	Traffic accidents	-	M	ST	Yes	No	Moderate	Slight or none	Moderate
	Road Damage	-	M	ST	Yes	Yes	Moderate	Slight or none	Moderate
	Littering and cleanliness during waste transit	-	L	ST	Yes	Yes	Moderate	Slight or none	Slight or none
Noise	Noise arising from operations on IDS and SWDS	-	M	LT	Yes	No	Moderate	Moderate	Moderate
	Noise from vehicle and equipment operations on the landfill	-	M	LT	Yes	Yes	Moderate	Moderate	Moderate
	Noise arising from crushers and shredders during construction and in VROMI yard (operational phase)	-	M	LT	Yes	Yes	Moderate	Moderate	Moderate
Geology and soils, slope stability	Impacts from slope instability Soil	-	S	P	Yes	No	Moderate	Positive	Slight or none
	Impacts on soils in VROMI yard from crusher, shredder and ELV collection (operation phase)	-	M	LT	Yes	Yes	Moderate	Moderate	Slight or none
Hydrogeology, Hydrology, and	Existing runoff, leachate, and groundwater discharges to the Great Salt Pond from the SWDS/IDS	-	M	LT	Yes	No	Moderate	Positive	Slight or none

Impact Category	Nature of the change	Type of impact (+) positive (-) negative	Size/ Scale/ Intensity Low = L Moderate = M Significant = S	Duration/frequency Short term = ST Long term = LT Permanent = P	Cumulative Yes No	Mitigation / Management Necessary	Magnitude of Impacts		
							During activities without mitigation	Operational phase	Magnitude of Impact 'With Mitigation' during activities
Surface Water Quality	Increased runoff and leachate discharges to the Great Salt Pond from SWDS/IDS during slope stabilization and recontouring	-	L	ST	Yes	Yes	Moderate	Slight or none	Slight or none
	Increased suspended sediment loading and runoff from SWDS/IDS during slope stabilization and recontouring	-	M	ST	Yes	Yes	Moderate	Slight or none	Slight or none
	Contamination of topsoil through imported materials	-	M	LT	Yes	Yes	Moderate	Slight or none	Slight or none
Ecology	Loss of biological habitats	-	M	LT	Yes	Yes	Significant	Positive	Moderate
	Extension of habitats (buffer zones)	-	L	LT	Yes	No	Significant	Positive	Moderate
	Creation of new habitats (post-closure)	+	M	P	Yes	No	Slight or none	Positive	Slight or none
	Introduction of invasive species through soil brought in from outside Sint Maarten	-	S	P	Yes	Yes	Significant	Slight or none	Moderate
Worker health and safety (also applicable to waste pickers)	Direct exposure to hazardous material	-	M	LT	Yes	Yes	Significant	Slight or None	Moderate
	Exposure to smoke/dust/landfill gas emissions	-	M	ST	Yes	Yes	Significant	Slight or None	Moderate
	Accidents during slope recontouring and closure activities	-	M	ST	Yes	Yes	Significant	Slight or None	Moderate
	Risk of drowning	-	S	LT	No	Yes	Moderate	Slight or none	Slight or none
	Exposure to vermin acting as disease vectors	-	M	LT	Yes	Yes	Significant	Positive	Moderate

Impact Category	Nature of the change	Type of impact (+) positive (-) negative	Size/ Scale/ Intensity Low = L Moderate = M Significant = S	Duration/frequency Short term = ST Long term = LT Permanent = P	Cumulative Yes No	Mitigation / Management Necessary	Magnitude of Impacts		
							During activities without mitigation	Operational phase	Magnitude of Impact 'With Mitigation' during activities
Public Health and Safety	Risk of traffic accidents	-	M	LT	Yes	Yes	Significant	Slight or none	Moderate
	Slope instability and potential collapse	-	L	P	No	Yes	Moderate	Moderate	Moderate
	Exposure to smoke/dust emissions	-	M	LT	Yes	Yes	Significant	Positive	Moderate
	Exposure to vermin acting as disease vectors	-	L	LT	Yes	Yes	Moderate	Positive	Moderate
	Risk of traffic accidents	-	M	ST	Yes	Yes	Significant	Slight or none	Moderate
Aesthetic affects	Recontouring and resloping of SWDS/IDS upon visual amenity	+	M	P	Yes	Yes	Significant	Positive	Moderate
Archaeological, Historic, and Cultural Heritage	Neglect of the historical and cultural significance of GSP	-	M	LT	Yes	Yes	Moderate	Positive	Moderate
Natural Disaster Risk	Instability of the landfill slopes in the event of a significant rain and wind event	+	M	ST	Yes	Yes	Moderate	Positive	Slight or none
	Reduction of water quantity buffering capacity of the GSP due to installation of the new ring dike	-	L	P	No	Yes	Moderate	Slight or none	Slight or none

6 Stakeholder engagement and communications plan

6.1 Objectives of Stakeholder Engagement

The objectives of stakeholder engagement, outlined in this plan, are to:

- Promote the development of respectful and open relationships between stakeholders and the Project proponent and other relevant parties during project phases
- Identify Project stakeholders and understand their interests, concerns and influence in relation to Project activities, particularly during the construction and operational phases
- Provide stakeholders with timely information about the Project, in ways that are appropriate to their interests and needs, and appropriate to the level of expected risk and potential adverse impacts
- Support alignment with financing standards and guidelines for stakeholder engagement, as necessary in the pre-construction phase; and
- Record and resolve any grievances that may arise from Project-related activities through a Grievance Redress Mechanism (GRM)

6.2 Stakeholder Engagement Plan

6.2.1 Stakeholder analysis

Based on the additional activities, especially concerning the IDS side of the area, the stakeholders are as follows:

Decision makers:

- The executive branch of the Government of Sint Maarten – Sint Maarten Council of Ministers, Ministry of (VROMI), Ministry of Public Health, Social Development and Labor (VSA), Ministry of Youth, Culture and Sport, Ministry of Tourism, Economic Affairs, Transport and Telecommunications (TEATT), Ministry of Finance, Ministry of Justice
- The legislative branch of the Government of Sint Maarten – Parliament of Sint Maarten
- Project Proponents and Project Funders – World Bank, Government of the Netherlands, NRPB

Facility owners / operators

- Ministry of (VROMI)
- Steel Crushers B.V. – operating a facility for collection and scrapping of metals (mainly cars). Operating under a Long Lease of plot 192/2017 on the IDS side of the MSWDS
- Windward Roads B.V. having a facility within the main SWDS. This facility is not formalized (no official land lease is present)
- Sint Maarten Soccer Association, holding a Long Lease of plot 190/2016 on the IDS side of the MSWDS

Others affected by the construction and operations:

- Residents, business owners educational centers, sports activities and government activities on Pond Island
- Waste pickers

Our reference R005-1293149GMC-V05-tsz-NL

- Residents and businesses, educational centers, sports activities and government activities along Juancho Yrausquin Blvd, Walter A. Nisbeth Road between Juancho Yrausquin Blvd and the roundabout with Soualiga Road
- Civil society organization, NGOs (Nature Foundation, EPIC)
- Media
- Greater population of Sint Maarten (island-wide community)

6.2.2 Stakeholder Engagement Methods and Materials

In preparing the feasibility study, the consultant has had numerous meetings and consultations with VROMI, the NRPB, the World Bank, and the representative of the Netherlands to the Sint Maarten Recovery, Reconstruction and Resilience Trust Fund since 2018. Through these meetings, the landfill options were discussed, refined, and determined, including potential E&S risks for the options. VROMI reached out to Steel Crushers, WWR, and the Soccer Association to inform of the landfill activities and their relocations between May and June 2025. These meetings and consultations have informed the development of the ESIA update. On September 3rd 2025 a public stakeholder consultation was held (see Chapter 7).

During pre-construction and construction phases, the engagement process encourages meaningful participation by stakeholders. The NRPB uses a range of methods and channels for disclosing information in order to tailor disclosure to the interests and needs of the various stakeholder groups and will also produce materials appropriate for specific stakeholders and types of engagement. This may include typical disclosure and engagement methods, such as:

- Local Newspaper Articles, Radio, Television Pieces, or Digital Media – Used to convey information to local audiences about proposed Project activities and progress (particularly relevant for any future offshore construction work)
- Internet/Website - Used to promote information or invite stakeholder queries and comments via e-mail
- Grievance Redress Mechanism (GRM) - Used by the public to obtain information, ask questions or report and get responses to grievances. The NRPB has an established GRM
- Public Education Outreach - use the general public and media outreach efforts as described in this section to raise awareness on key issues of the Project, specifically

The stakeholder engagement process includes two-way targeted engagement related to specific potential Project impacts. However, engagement activities continue to be organized around specific topics of interest and known concerns of stakeholders. Feedback mechanisms are adapted to suit the needs and preferences of different stakeholders and their physical locations.

6.3 Grievance Redress Management

The NRPB has a GRM at the organization level and accepts grievances for all its projects, including EDMP. GRM is accessible by all stakeholders. It accepts anonymous grievances. The contact information and the complaint handling procedure is summarized below:

Our reference R005-1293149GMC-V05-tsz-NL

NRPB website: [Complaints Procedure](#) (including on-line complaint submission form)

Telephone: +1(721) 542-8886/7

E-mail: complaints@nrpbxsm.org

In-person: National Recovery Program Bureau (NRPB)

#57 Walter A. Nisbeth Road

Philipsburg, Sint Maarten

- **Sorting, processing.** Any complaint received is forwarded to Complaint Officer, logged in the NRPB GRM database upon its receipt. The complaint is categorized according to the following complaint types: civil work (damage, dust, noise, et cetera), resettlement, application, communication/consultation, conduct, working conditions, Sexual Exploitation and Abuse (SEA) or Sexual Harassment (SH), and 'other'
- **Acknowledgement and follow-up.** Receipt of the grievance is acknowledged to the complainant by the Complaint Officer within five working days
- **Verification, investigation, and action.** Investigation of the complaint is led by the Complaint Officer, in collaboration with the relevant project team (EDMP, in case of landfill activity related complaints) and/or technical units within 10 working days. A proposed resolution is formulated by the Complaint Officer and communicated to the complainant by the Complaint Officer as soon as possible, not to exceed 6 weeks. If the complaint is not redressed within 10 working days, the Complainant Officer sends a follow-up message to provide update
- **Monitoring and Evaluation.** Data on complaints are collected in the NRPB GRM database and reported to the project team and the Bank semi-annually
- **Provision of feedback.** If there is no follow-up message from the complainant, the case is closed in one month after the NRPB's response to the complainant
- **Escalation Process.** The complainant can appeal to NRPB senior management. A case specific review panel will be set up for redressal
- **SEA/SH related grievances.** The NRPB GRM has an uptake mechanism for SEA/SH related grievances. Survivors are referred to government or NGO service providers

7 Public Consultation Report

The process, attendance and results of the first ESIA consultations are presented in annex J of the original ESIA drafted in 2023, which was in line with the World Bank requirements and Appendix 1 of the current report detailing the public consultations associated with the current document. More than 200 people participated in person for the second round of consultations, and about 30 participated online. About 85 participants were women, and 25 were elderly. There also were more than 30 community members who used to live in RAI (PAPs) or who currently live next to RAI. The presentations of the public consultations connected with this ESIA, questions and answers are included in Appendix 1. The public consultation can be found [here](#), questions and answers have been disclosed [here](#).

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Appendix 1 Outcomes of Stakeholder Consultations

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Appendix 2 Ordinance, policies and decrees

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Table A2.1 Summary of Environmental and Social Legislation (source ESIA Sint Maarten Emergency Debris Management Project (P-167347) January 31st, 2023)

General Environmental and Social Considerations	National Laws and Requirements
Environmental and Social Assessment.	<p>The National Ordinance Structure and Organization of National Government (AB 2010, GT no. 6 and AB 2014, no. 29).</p> <p>The Organization Decree Public Housing, Spatial Planning, Environment and Infrastructure (AB 2010, no. 8, AB 2013, GT no. 145 and AB 2014, no. 67).</p>
Labour and Working Conditions	<p>Labour Legislation of St Maarten</p> <p>National ordinance concerning safeguarding labor in enterprises a.k.a. Safety Ordinance (AB 2013, GT no. 438).</p> <p>Safety Decrees I-III (AB 2013 GT no. 348; no. 280; no. 350)</p> <p>A National HIV and AIDS Workplace Policy (2012)</p>
Resource Efficiency and Pollution Prevention Management	<p>National Energy Policy (2014)</p> <p>The current Electricity Concessions Ordinance (AB 2013, GT no. 147) and the Electricity Concession of N.V. GEBE</p> <p>Waste Ordinance (AB 2013, GT no. 135).</p> <p>National Ordinance Wastewater (AB 2013, GT no. 142)</p> <p>The National Ordinance for Nature Protection and Management (AB 2013, GT no. 809)</p>

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	<p>The National Ordinance for the Prevention of Pollution from Ships (AB 2013, GT No. 298)</p> <p>National Ordinance Clearance of Ships and Wrecks (AB 2013, GT no. 314)</p> <p>Environmental Norms for Air & Sound, Water & Wastewater, Waste</p> <p>Article 28a of the Lrop (26 April, 2021)</p>
<p>Community Health and Safety</p>	<p>Nuisance Regulation (AB 2013, GT no. 139).</p> <p>Hindrance Ordinance and derivative regulations. (AB 2013 GT nr. 139 and AB 2013 GT nr. 140).</p> <p>National Ordinance Public Health (AB 2018, 20).</p> <p>National Decree of the Governor of Sint Maarten Concerning Public Health Rules National Decree on Public Health (AB 2017, GT No. 33).</p>
<p>Land Acquisition, Restriction on Land Use and Involuntary Resettlement</p>	<p>St. Maarten adopted its own Planning and Zoning Ordinance in 1993 (Eilandsverordening Ruimtelijke Ontwikkelingsplanning St. Maarten, "EROP") and it is updated in 2013 which is the National Ordinance Spatial Development Planning (AB 2013, GT no. 144).</p> <p>National ordinance, concerning Building- and Public Housing a.k.a. Building Ordinance (AB 2013, GT no. 136). There are two National Decrees for execution of Article 19 (AB 2013, GT no. 146) and Article 43 (AB 2013, GT no. 401) of the Building Ordinance.</p> <p>As per April 26, 2020 Article 28a of the National Ordinance Spatial Development Planning (Lrop) has recently come back into effect.</p> <p>Article 28a. regulates the requirements for a civil works permit, which will allow the Minister to review certain planned works prior to approval. This will ensure that the works will not cause undesirable and irreversible damage to the environment and are executed with concern to the environment and that the works fit within the Government Spatial Development Vision.</p> <p>In addition, the article allows the government to impose conditions on the</p>

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	<p>execution of the works. Approval by the Minister would be required for the following works:</p> <ul style="list-style-type: none"> • The excavation, raising, leveling or explosion of land; • The construction of roads and other pavements; • Works and projects that impact the water management and the groundwater level; • The felling and clear-cutting of trees or other cultivation; • The demolition of structures; • The filling and/or dredging of water.
<p>Biodiversity Conservation and Sustainable Management of Living Natural Resources</p>	<p>National ordinance, concerning management of nature and protection of the prevalent fauna and flora (AB 2013, GT no. 809).</p> <p>National Decree, entailing general measures, concerning management and protection of flora and fauna as well as nature parks (AB 2013, GT no. 143).</p> <p>There are two relevant island policies that are not covered by legislation; Beach Policy (Public notice August 1994). Hillside Policy (Public notice No. 986/98).</p> <p>Temporary Fishing Prohibition Cartilage Fish Decree (AB 2011, no. 35).</p> <p>Fisheries Land Decree (AB 2013, GT no. 405).</p> <p>Fisheries Products National Decree (AB 2013, GT no. 354).</p> <p>National Nature Conservation Ordinance – Ao2001, No. 41;</p> <p>Nature Conservation Ordinance St, Maarten- AB2003, No. 35</p> <p>St Maarten Proposed Land Parks Management Plan (2009);</p> <p>Sint Maarten Nature Policy has been approved; in the process to be published..</p>
<p>Cultural Heritage.</p>	<p>The Philipsburg Declaration and Action Plan (2015)</p> <p>National decree, entailing general measures of the execution of the Monuments ordinance (AB 2013, GT no. 50).</p>

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	National decree indicating protected monuments (AB 2013, GT no. 46). National decree monuments register (AB 2013, GT no. 49).
Stakeholder Engagement and Information Disclosure.	There is no national law or regulation.

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Appendix 3 Extract Monuments Register

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Appendix 4 Draft Implementation Schedule

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Appendix 5 Extract of Pond Island Ownership

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Appendix 6 Assessment of Buffer Capacity Great Salt Pond

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Appendix 7 Overview of Bird Species

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Table A7.1 Overview of bird species with more than 10 recorded individuals at the GSP

English Name	Latin Name	Breeding bird on St Maarten	Number of identified birds at the GSP	Main function of GSP mangroves
Common Gallinule	Gallinula galeata	Yes	751	Nesting
Great Blue Heron	Ardea herodias		234	Foraging
Least Tern	Sternula antillarum	Yes	19	
Magnificent Frigatebird	Fregata magnificens	Yes	981	
Snowy Egret	Egretta thula	Yes	1253	Nesting, Foraging, Roosting
American Coot	Fulica americana	Yes	128	Nesting, Foraging, Roosting
Spotted Sandpiper	Actitis macularius		174	
Black-necked Stilt	Himantopus mexicanus	Yes	1570	
American Kestrel	Falco sparverius	Yes	18	
Lesser Antillean Bullfinch	Loxigilla noctis	Yes	62	Nesting, Foraging, Roosting
Zenaida Dove	Zenaida aurita	Yes	238	Nesting
White-cheeked Pintail	Anas bahamensis	Yes	1139	Nesting, Foraging, Roosting
Belted Kingfisher	Megaceryle alcyon		17	Foraging
Blue-winged Teal	Spatula discors		84	Foraging
Barn Swallow	Hirundo rustica		844	
Brown Pelican	Pelecanus occidentalis	Yes	2792	Foraging, Roosting
Carib Grackle	Quiscalus lugubris	Yes	669	Nesting
Pied-billed Grebe	Podilymbus podiceps	Yes	46	Nesting, Foraging
Yellow-crowned Night Heron	Nyctanassa violacea	Yes	46	Nesting, Foraging, Roosting
Gray Kingbird	Tyrannus dominicensis	Yes	285	Nesting, Foraging

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English Name	Latin Name	Breeding bird on St Maarten	Number of identified birds at the GSP	Main function of GSP mangroves
Green Heron	<i>Butorides virescens</i>	Yes	306	Nesting, Foraging, Roosting
Sandwich Tern	<i>Thalasseus sandvicensis</i>	Yes	42	
Great Egret	<i>Ardea alba</i>	Yes	1978	Nesting, Foraging, Roosting
Western Cattle-Egret	<i>Ardea ibis</i>	Yes	2343	Nesting, Foraging, Roosting
Royal Tern	<i>Thalasseus maximus</i>	Yes	398	
Laughing Gull	<i>Leucophaeus atricilla</i>	Yes	14128	
Black-faced Grassquit	<i>Melanospiza bicolor</i>	Yes	78	
Common Ground Dove	<i>Columbina passerina</i>	Yes	114	
Ruddy Duck	<i>Oxyura jamaicensis</i>	Yes	413	Foraging
Bananaquit	<i>Coereba flaveola</i>	Yes	375	Nesting, Foraging
Tricolored Heron	<i>Egretta tricolor</i>		10	Foraging
Pearly-eyed Thrasher	<i>Margarops fuscatus</i>	Yes	11	Nesting, Foraging
Black-bellied Plover	<i>Pluvialis squatarola</i>		67	Foraging